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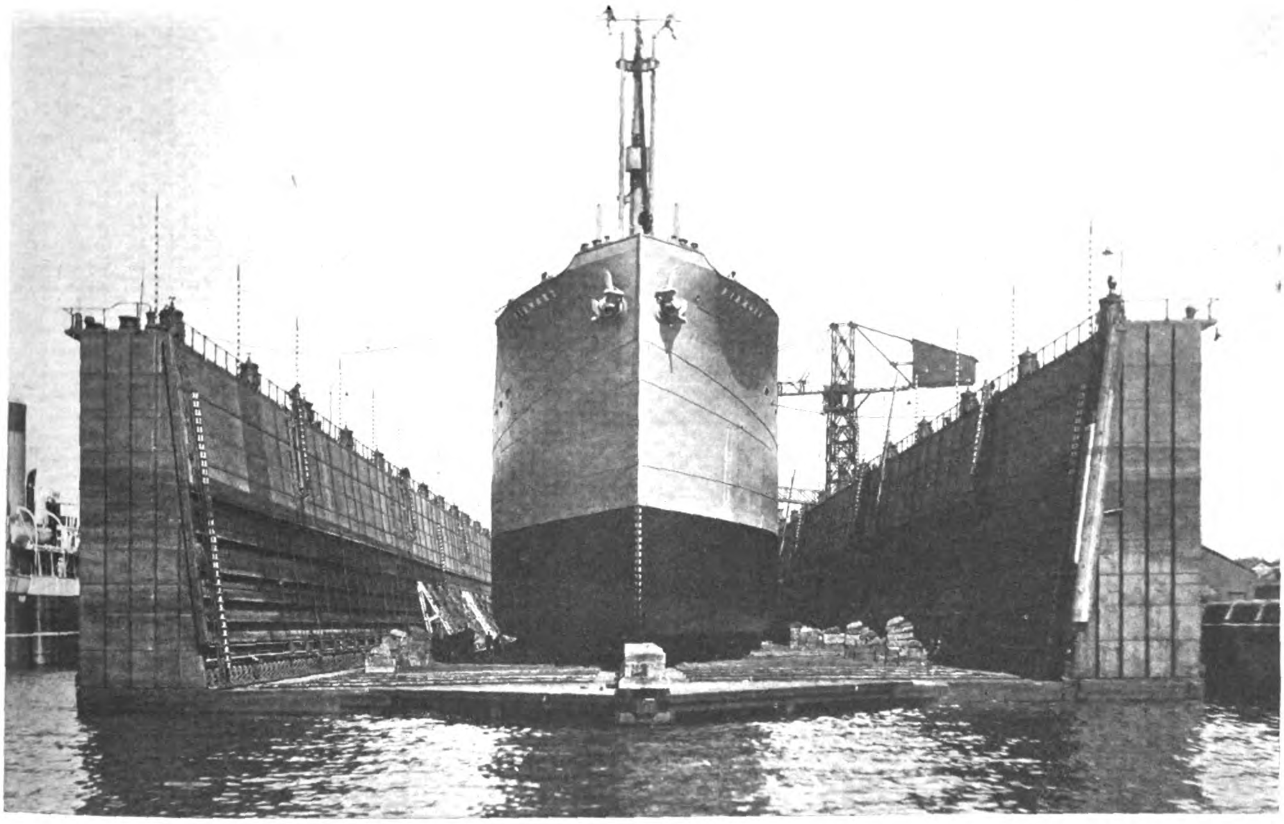


Fig. 1.—Sparrow's Point Dry Dock With 7,000-Ton Steel Ore Vessel in Dock. View Taken from Bay

Twenty-Thousand-Ton Floating Dry Dock

Bethlehem Shipbuilding Corporation, Ltd., Places In Operation at Its Sparrows Point Plant Huge Dry Dock Designed by William T. Donnelly

THE new floating dry dock recently completed by the Bethlehem Shipbuilding Corporation, Ltd., at their Sparrow's Point plant, Sparrow's Point, Md., is a good example of what is modern in dry dock construction. It is of the pontoon type, making use of individual wooden pontoons and continuous side wings of steel, and is electrically operated from a control house on the shore. It has a capacity of 20,000 tons, is 600 feet in length by 130 feet wide and is suitable for accommodating vessels with a draft of 24 feet.

Twelve wooden pontoons are employed, each independent of the other, but attached to the side wings in such a manner that the wings act as continuous girders extending the full length of the dock. Each pontoon is divided into two compartments by a watertight bulkhead extending lengthwise through its center. The pumping machinery consists of twenty-four centrifugal pumps, direct-connected to electric motors vertically mounted on the decks of the side wings in watertight casings, as shown in the accompanying illustrations, and remotely controlled from a control house located on the shore.

One pump is located in each compartment of a pontoon, and electrical connections are such that by means of individual switches the pumps of any pontoon can be operated independently of those of the others, or by means of a master switch the pumps of all twelve pontoons can be operated simultaneously. This feature provides means whereby the stresses in the boat being docked may be equalized by utilizing the individual control and bringing a decreased or increased upward pressure to bear on certain pontoons, as required.

In addition to the centrifugal pumps, which are used

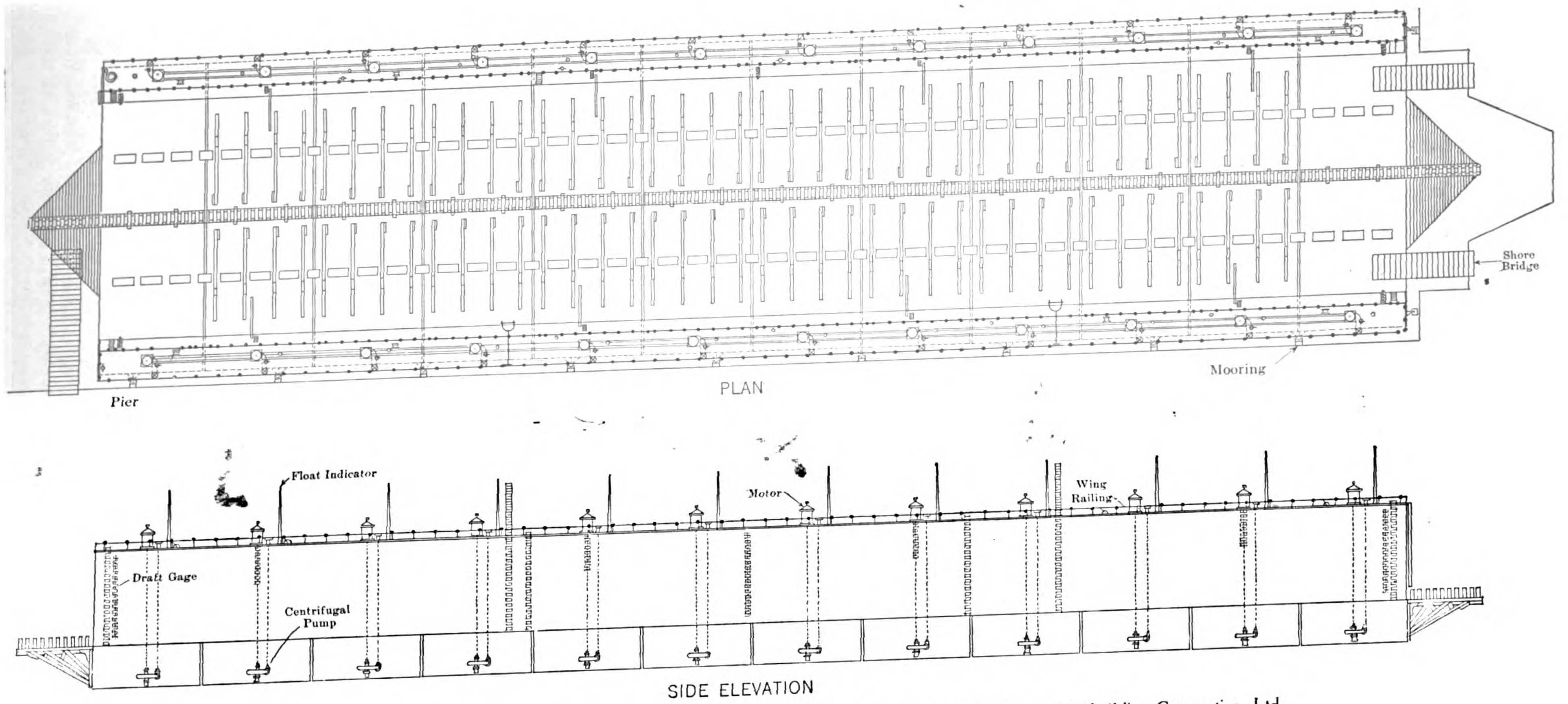
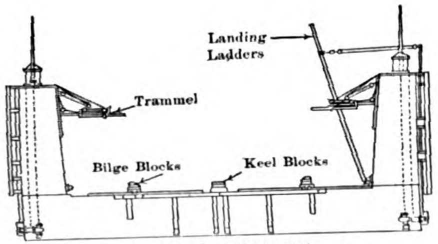
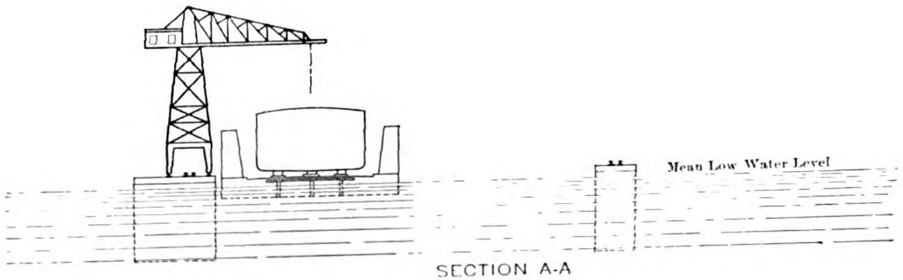

Shore Bridge
Mooring
PLAN
Pier
Float Indicator
Motor
Wing Railing
Draft Gage
Centrifugal Pump
SIDE ELEVATION

Fig. 2.—Plan and Elevation of 20,000-Ton Floating Drydock at Sparrow's Point Plant of Bethlehem Shipbuilding Corporation, Ltd.


Landing Ladders
Trammel
Bilge Blocks
Keel Blocks

END ELEVATION
Fig. 3


Mean Low Water Level

SECTION A-A
Fig. 4

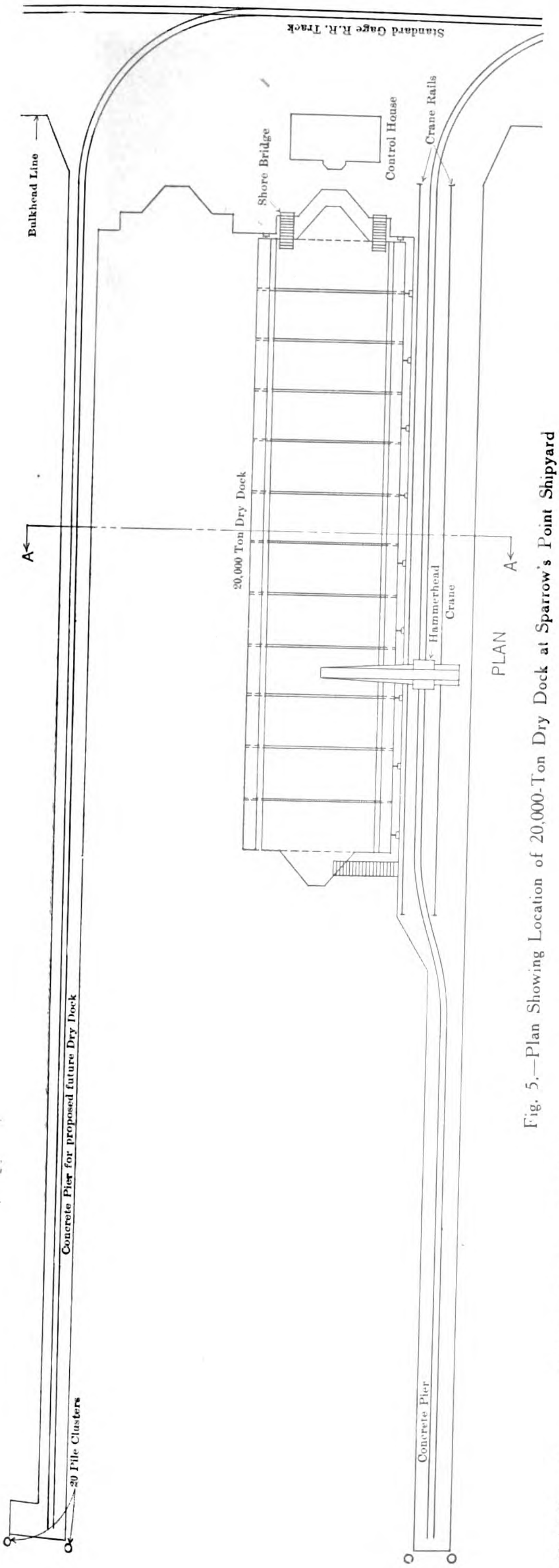


Fig. 5.—Plan Showing Location of 20,000-Ton Dry Dock at Sparrow's Point Shipyard

for emptying and thereby raising the pontoons, each pontoon is provided with two gate valves for filling and submerging. The gate valves are located in each end of the pontoons and so arranged that the same ports are used in filling the pontoons and in pumping the water out. Operation of the valves is by hand from hand-wheels located on the decks of the wings.

WINGS

The wings are 40 feet high and 15 feet wide at their bases. They are of watertight construction and communicate at their bases with the compartments of the pontoons. In order to aid in the submergence of the dock, ballast in the form of timber properly distributed is placed in the upper part of the wings. This timber ballast also serves the purpose of a float to prevent the submergence of the dock below the depth desired.

In the construction of the piers, provision was made for a future dry dock to be built on the north side of the present one, as shown in the plan view, Fig. 5. The piers are of concrete with pile foundations and extend out into the bay a distance of 1,260 feet. The dock is moored to the south pier and to the bulkhead by means of moorings of steel construction anchored in the concrete about 16 feet back from the pier and bulkhead lines.

An electrically operated hammer-head crane with a capacity of 22 tons at a radius of 40 feet is located on the south pier to take care of any work to be handled in the dock. The crane has a maximum radius of 90 feet, a minimum radius of 12 feet and a lift of 90 feet.

TIME REQUIRED FOR DOCKING VESSEL

Observations taken in a number of cases show the following to be the average time required to complete the various operations in docking a vessel under ordinary conditions:

Average time to submerge dock from 18 feet on draft gage to dock level, or a total of 22 feet, allowing 4 feet for keel blocks	25 minutes
Average time required for towing vessel in dock, centering same, adjusting lines, etc.	25 minutes
Average time to raise the vessel in dock up to deck level of dock, or 22 feet...	43 minutes
Total time for docking	1 hour 33 minutes

It is to be noted that the above figures include the time required to open and close valves, start motors, etc., in each case, as required. The actual rate of submerging and raising after the dock has started and is under way is approximately one foot per minute—that is, with all gates open when submerging and with gates closed and all motors operating at full speed when raising.

During the first month of operation, April, 1919, a total of 15 vessels were docked at Sparrow's Point, aggregating a gross tonnage of 45,000.

The Sparrow's Point dock was designed by William T. Donnelly, consulting engineer, New York City, and constructed by the Sparrow's Point plant of the Bethlehem Shipbuilding Corporation.

The Sea-Going Tug Basswood

THE sturdy design and construction of the sea-going tug *Basswood*, recently built for the Government by the Bayles Shipyard, Inc., Port Jefferson, Long Island, N. Y., will enable the vessel to fulfill the requirements and take the highest class of either the American Bureau of Shipping or Lloyd's Register of Shipping, although the

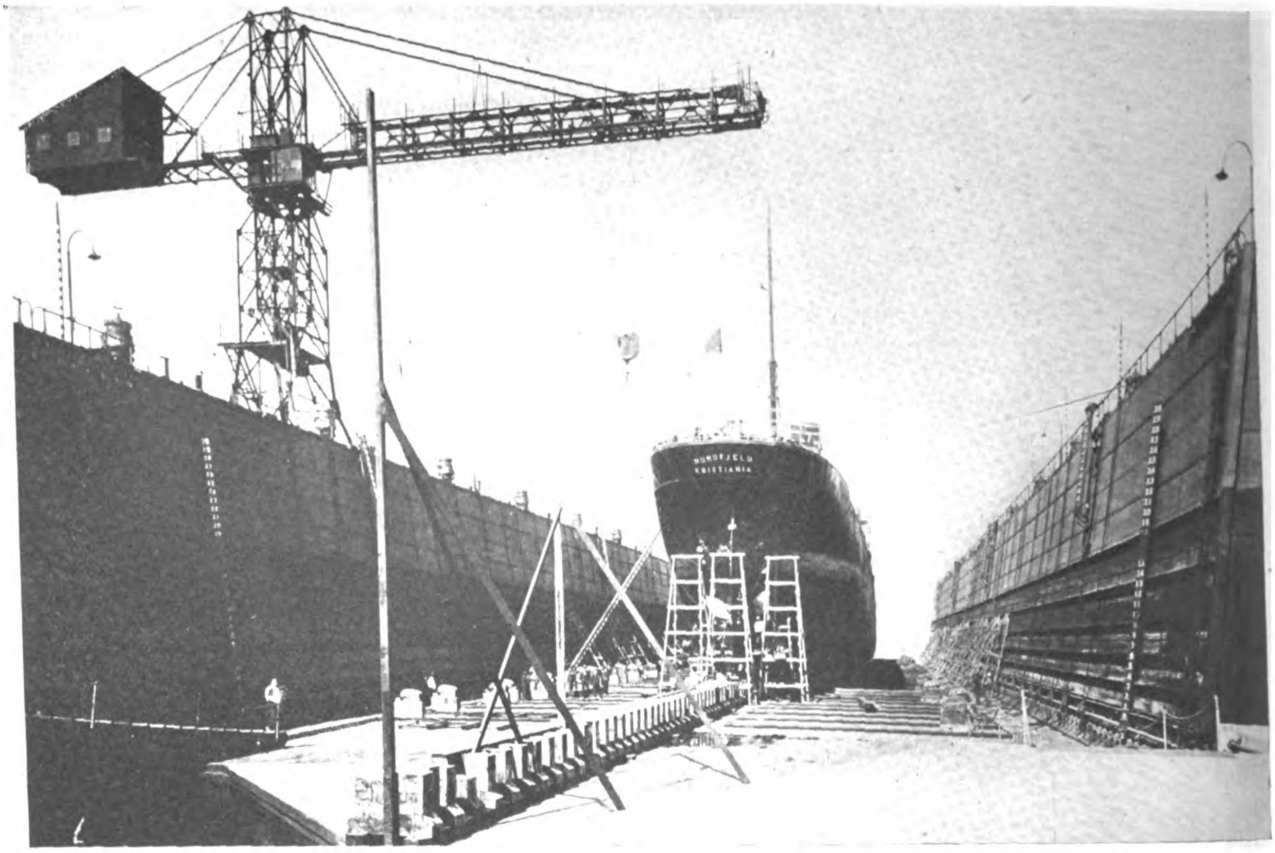


Fig. 6.—Sparrow's Point Dry Dock With Vessel in Dock. Viewed from Shore, Showing Hammerhead Crane

specifications did not require construction to meet any classification society's rules.

The principal dimensions of the *Basswood* are as follows:

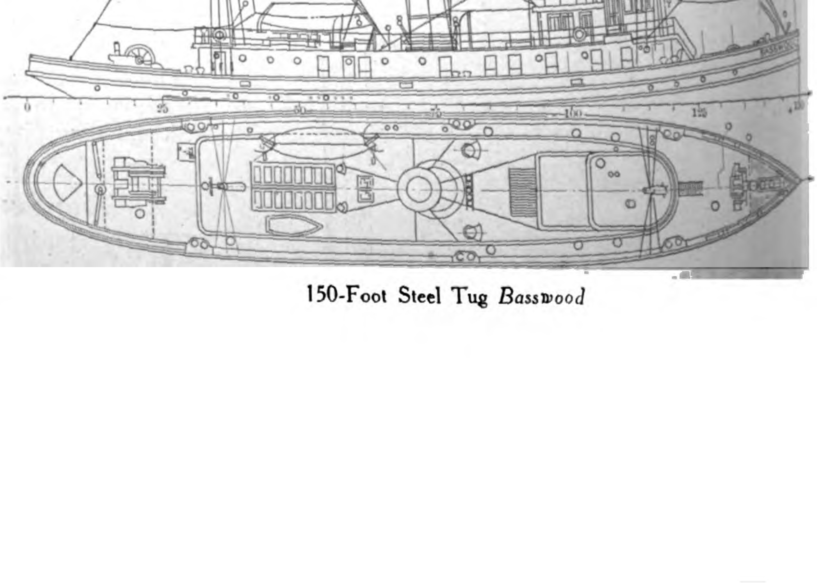
Length, after side of stem to after end of main deck	150 feet 0 inches
Length, forward side of stem to after side of rudder post	141 feet 3½ inches
Beam, molded	27 feet 6 inches
Depth, molded	16 feet 8 inches

The hull is of steel with bar keel, single bottom and solid floor construction throughout. The frames and beams are of bulb angle sections. Special ice protection is provided at the forward end by means of intermediate frames. The hull is divided into six compartments by means of three watertight and two screen bulkheads.

The deck house is of steel, above which is a wooden pilot house with a wooden house aft of the same for the captain's quarters. Rooms are arranged in the deck house for the chief engineer, assistant engineer, mate, oilers, steward and wireless operator, and, in addition to these, the galley, officers' mess, radio room and spare room and two toilets. Quarters for the balance of the crew are provided below the main deck forward of the coal bunkers. Access to this space is provided by a companionway in the forward end of the deck house.

The steering gear is steam-operated, the steering engine being placed on the lower deck aft of the engine casing. Control is by means of steel shafting and brass gears from the wheel in the pilot house.

An approved steam brake windlass is fitted on the lower deck forward, of sufficient power for handling 1,500-pound anchors. The deck fittings include six large side



150-Foot Steel Tug *Basswood*

bitts and two towing bitts, one forward and one aft, and other necessary chocks, cleats and fairleads.

The life-saving equipment consists of one 20-foot metallic lifeboat and one 10-foot wooden working boat, both stowed on the top of the deck house and handled by the usual type of rotating davits.

The vessel is rigged with two wooden pole masts and with fore staysail, foresail, main staysail and mainsail.

The main propelling engine is of the inverted-cylinder, vertical, direct-acting, three-cylinder, triple-expansion type, with cylinders 17 inches, 25 inches and 43 inches diameter, having a stroke of 30 inches. The high-pressure cylinder is at the forward end and the low-pressure aft. The engine is provided with steam reversing gear and a hand-turning gear.

The thrust block is of cast iron of the adjustable type with 12 yokes, 7 for ahead and 5 for astern.

The stern tube is of cast iron, bolted to the after peak bulkhead and secured to the stern post by a shoulder and cast steel nut. The bearing consists of a composition bushing fitted with lignumvitae bearing blocks.

Auxiliary machinery in the engine room consists of independent air pump, circulating pump, feed pump, fire pump, sanitary pump and filter box and feed water heater.

Electric current is generated by a 7-kilowatt generator and is used for general lighting and to operate the searchlight.

Steam for the main engine and auxiliaries is supplied by two coal-burning boilers of the Scotch marine type. The boilers are 11 feet 6 inches inside diameter and 12 feet long over the heads. Each boiler is fitted with two corrugated Morrison furnaces 46 inches inside diameter and a single combustion chamber. The boilers are built for a working pressure of 180 pounds per square inch.

Feed water for the boilers is carried in the forward and after peak tanks and coal in a cross bunker forward of the boiler room.

Ventilation of the engine and boiler rooms is provided by large cowl ventilators, and the engine room is further ventilated and lighted by a large wooden skylight operated from the upper engine room grating.

The smoke stack is double and extends about 35 feet 6 inches above the top of the deck house. The diameter of the inner stack is 57 inches and the outer 90 inches.

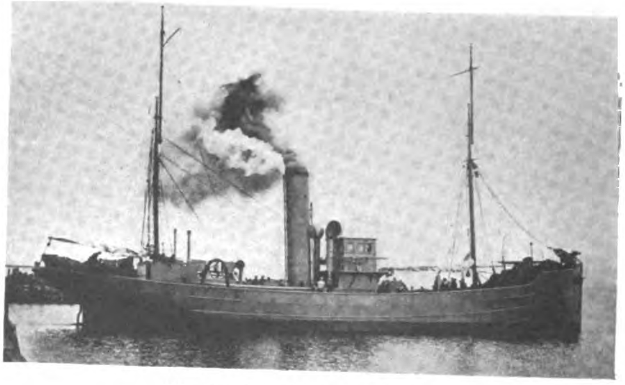


Fig. 2.—British Steel Trawler

Drifters and Trawlers

THE Anderson Company of Canada, Montreal, Can., has recently negotiated a contract with the British Government for the purchase of approximately sixty steel trawlers and eighty-nine wooden steam drifters. These vessels were used during the latter part of the war for mine sweeping and patrol service, but were built on the exact design and general arrangement of the British North Sea trawler and drifter, with the view to putting them in the fishing industry at the conclusion of the war.

The entire number of vessels originally contracted for was not completely finished until last summer, and none of the vessels is over one year and a half old. The following is a list of the builders of the vessels and the number of vessels built by each firm:

Drifters	
Canadian Vickers, Limited	26
Montreal Harbor Commissioners	4
Leclair & Sons, Sorel, Que.	6
Sorel Shipbuilding & Coal Company	8
Dominion Government Shipyard, Sorel	3
Jas. Sheppard & Sons, Sorel, Que.	3
Davie Shipbuilding & Repairing Company	50
	100

Trawlers	
Canadian Vickers, Limited	11
Dominion Government Shipyard, Sorel	6
Kingston Shipbuilding Company	6
Polson Iron Works	4
Thor Iron Works	2
Collingwood Shipbuilding Company	8
Port Arthur Shipbuilding Company	14
Davie Shipbuilding & Repairing Company	6
Tidewater Shipbuilders, Ltd.	3
	60

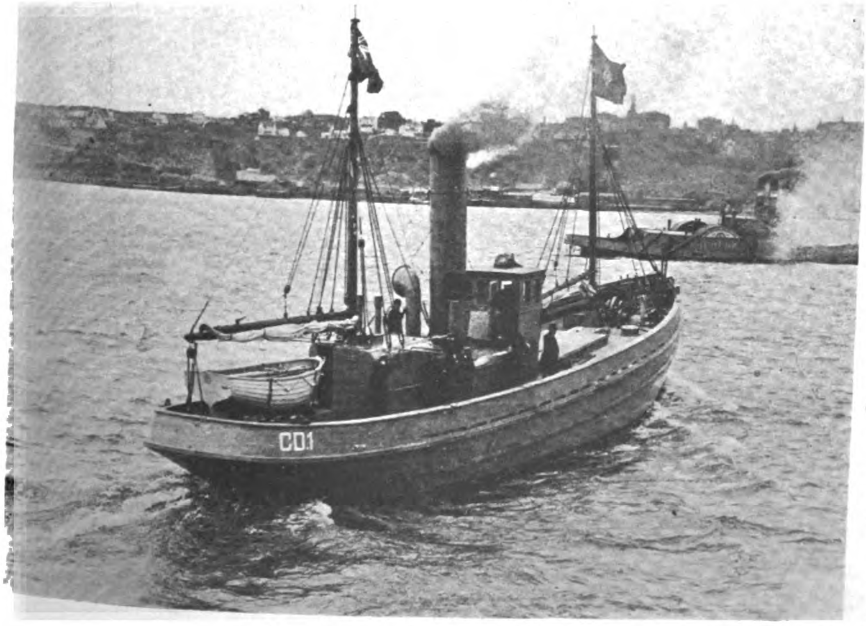


Fig. 1.—84-Foot British Wooden Drifter

Wooden Steam Drifter

The drifters are built of wood with a length of 84 feet, a breadth of 19¼ feet, and a draft aft of 9 feet.

These vessels are fitted with compound surface condensing engines having cylinders 12 inches and 24 inches diameter and a stroke of 16 inches, designed to indicate about 200 horsepower at 140 revolutions a minute, which gives the vessels a speed of 8½ knots.

Steam is supplied by a multitubular marine type boiler fitted with two furnaces designed for 140

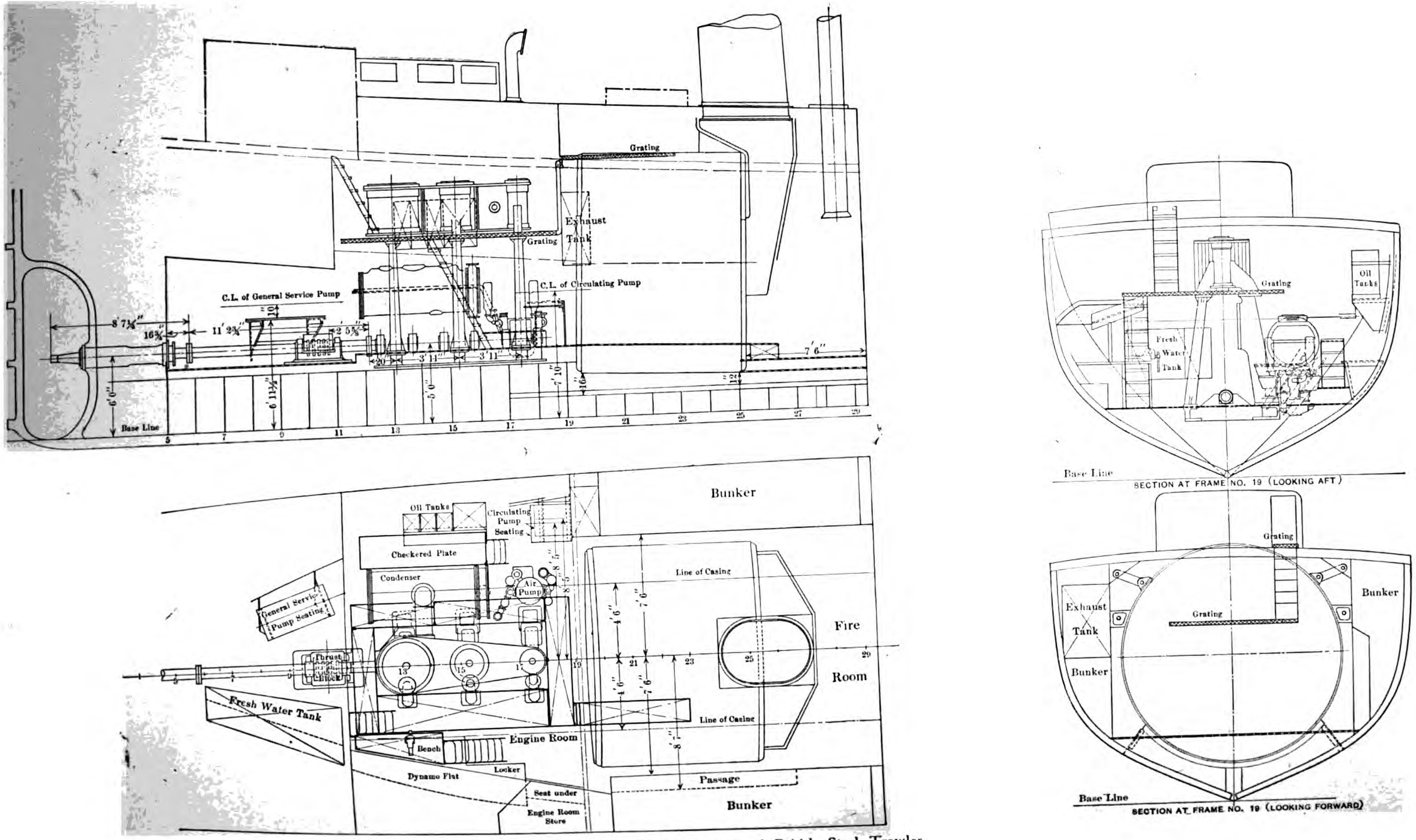

Grating
Exhaust Tank
Grating
C.L. of Circulating Pump
C.L. of General Service Pump
8′ 7¼″
16⅝″
11′ 2¾″
10″
2 5⅝″
20″
3′ 11″
3′ 11″
7′ 6″
6′ 0″
6′ 11½″
5′ 0″
7′ 10″
16″
12″
Base Line
5
7
9
11
13
15
17
19
21
23
25
27
29
Bunker
Oil Tanks
Circulating Pump Seating
Checkered Plate
Condenser
Air Pump
General Service Pump Seating
Thrust Block
Fresh Water Tank
Line of Casing
Fire Room
Line of Casing
Engine Room
Bench
Locker
Dynamo Flat
Seat under Engine Room Store
Passage
Bunker
8′ 5″
4′ 6″
7′ 6″
4′ 6″
7′ 6″
8′ 7″
Grating
Oil Tanks
Fresh Water Tank
Base Line
SECTION AT FRAME NO. 19 (LOOKING AFT)
Grating
Grating
Exhaust Tank
Bunker
Bunker
Base Line
SECTION AT FRAME NO. 19 (LOOKING FORWARD)

Fig. 3.—Machinery Arrangement of British Steel Trawler

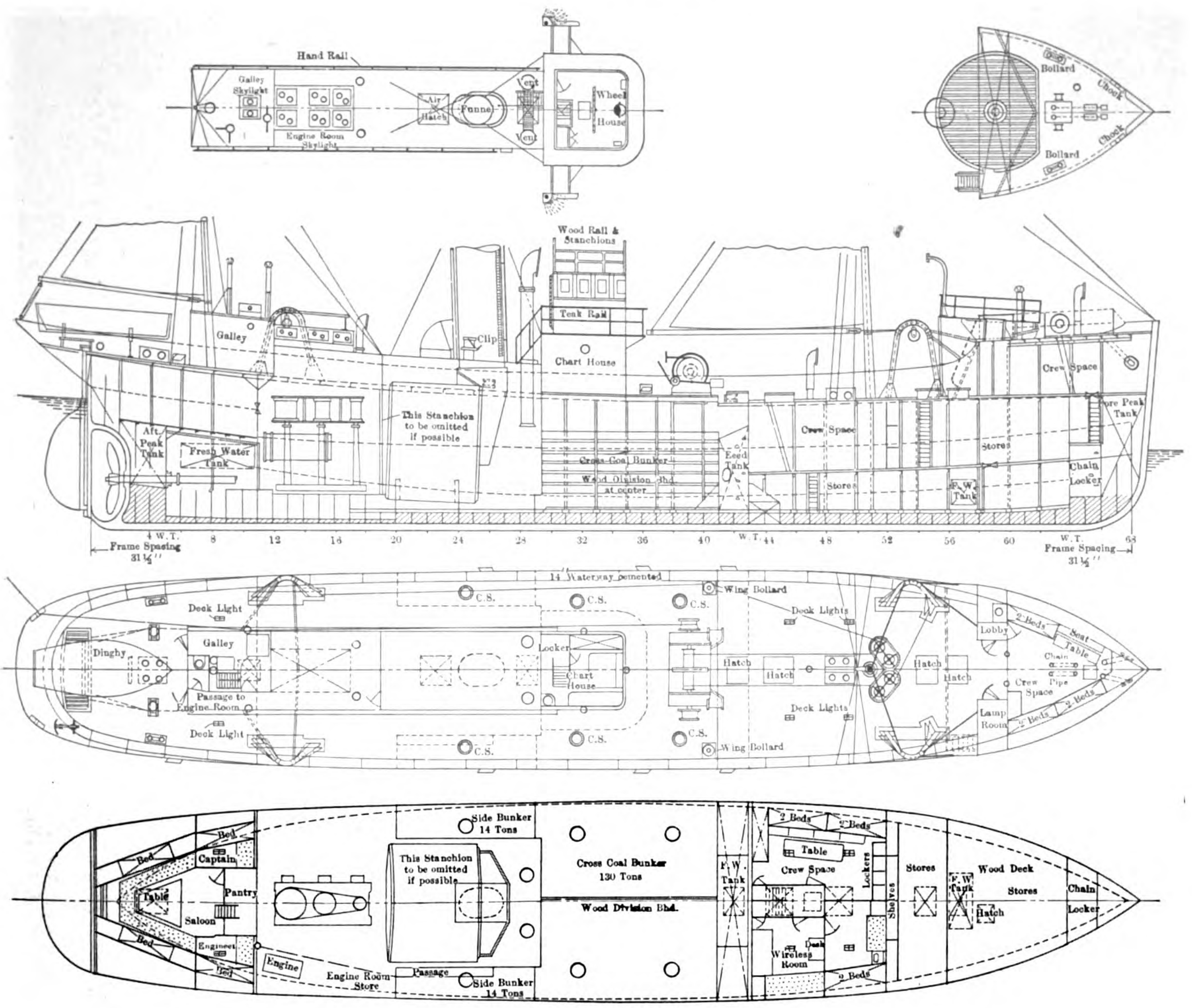

Hand Rail
Galley Skylight
Engine Room Skylight
Air Hatch
Funnel
Vent
Wheel House
Bollard
Chock
Wood Rail & Stanchions
Teak Rail
Chart House
Galley
Clip
This Stanchion to be omitted if possible
Aft Peak Tank
Fresh Water Tank
Cross Coal Bunker
Wood Division Bhd. at center
Feed Tank
Crew Space
Stores
F. W. Tank
Fore Peak Tank
Chain Locker
W.T. Frame Spacing 31¼"
Deck Light
Dinghy
Passage to Engine Room
C.S.
Locker
Wing Bollard
Deck Lights
Hatch
Lobby
Beds
Seat
Table
Chain Pipe
Crew Space
Lamp Room
Bed
Captain
Pantry
Table
Saloon
Engineer
Engine
Engine Room Store
Passage
Side Bunker 14 Tons
Cross Coal Bunker 130 Tons
Wood Division Bhd.
F. W. Tank
Lockers
Shelves
Desk
Wireless Room
Wood Deck
Chain Locker

Fig. 4.—General Arrangement Plans of British Steel Trawler

pounds working pressure working under natural draft.

The vessels are arranged in every way similar to the British herring drifters, a very large number of which are continually operating around the British Isles. Accommodation is arranged fore and aft for a crew of 10 men. Steel casings are fitted over the engine and boiler room, the after part of which forms a galley on deck, and the forward part the wheel house.

Coal bunker capacity is provided for 13 tons in side bunkers and 7 tons in a cross bunker. Two large tanks are fitted for supplying fresh water for the boiler.

These vessels are of a thoroughly seaworthy type and are able to proceed to all parts of the world under their own power.

STEEL STEAM TRAWLERS

The trawlers are built of steel; length 125 feet, breadth 23½ feet, molded depth 13½ feet. These vessels, when fully loaded and ready for sea, have a draft of water aft of 15 feet.

The machinery consists of triple-expansion engines having cylinders 12¾ inches, 21½ inches and 35 inches diameter by 24 inches stroke, capable of developing about 500 indicated horsepower at 118 revolutions a minute, which drives the vessel a speed of 10 to 11 knots. A separate surface condenser is fitted, also a direct-acting steam reversing engine and the most modern and up-to-date equipment for a vessel of this type. Steam is supplied by a large 3-furnace marine multitubular boiler of 180 pounds working pressure.

The coal bunker capacity is 160 tons, which will allow the vessel to remain at sea for 30 days. Fresh drinking water tanks of 10 tons capacity and feed water tanks of 15 tons are provided and accommodations arranged for 14 men.

The trawlers are fitted with a 7½-kilowatt generator, which serves for lighting the vessel and also for operating the wireless telegraph.

The whole of the fishing machinery is fitted on deck, arranged identically with the best type of British steam trawler. The fish bunkers have a capacity of 6,000 cubic feet.

The trawl winch, which plays an important part in fishing, has cylinders 9 inches in diameter by 14 inches stroke and works at full boiler pressure. The main shaft is of forged steel, 7 inches diameter, and carries two cast-steel barrels with heavy brass bushings and steel sides, each barrel being capable of winding 1,000 fathoms of steel cable. The main driving wheels are of helical cast steel gearing, and the main clutch gear, which engages the barrel, is of cast steel fitted on a square so as to do away with the use of keys. This winch, when complete, weighs over 9 tons.

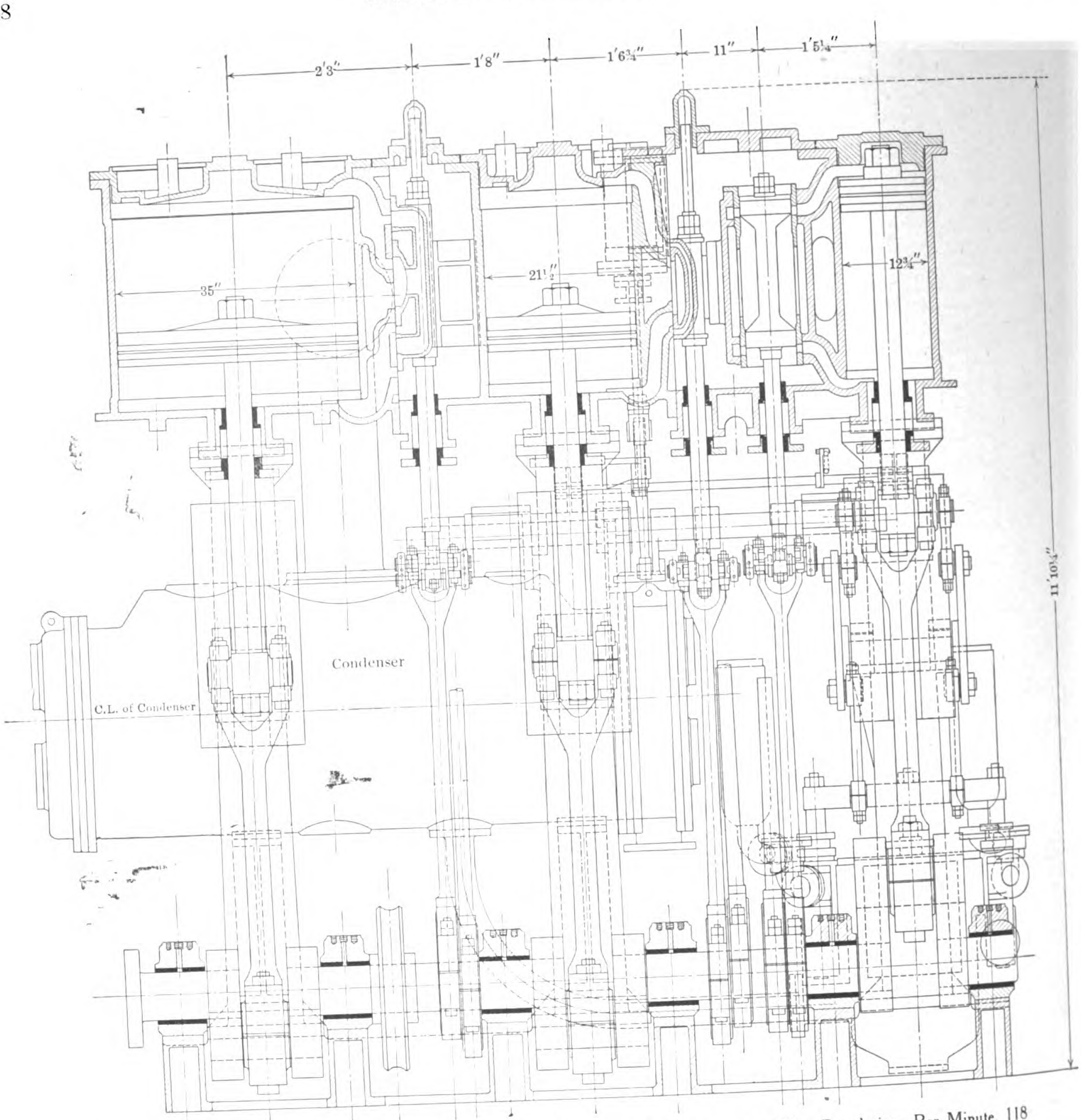


Fig. 5.—Triple Expansion Engine for British Steel Trawler. Indicated Horsepower, 500; Revolutions Per Minute, 118

Rebuilding a Former German Ship at the Panama Canal Shops

REBUILDING of the steamer *Callao,* one of the first of the ex-German interned steamers to arrive at the Panama Canal from Peru, was completed at the Balboa plant and the ship was accepted by the marine superintendent for the United States Shipping Board on April 5, 1919. Prior to her departure from the Balboa plant for New York, via the Canal, this vessel underwent a successful trial trip on April 2, during which her machinery was operated to maximum capacity.

The *Callao,* formerly known as the *Sierra Cordoba,* of the North German Lloyd Steamship Company, was one of four of the best-equipped passenger vessels of this company, plying between Bremen and Buenos Aires. Her principal dimensions are as follows:

Length overall	461 feet
Length of load waterline	438 feet
Beam (molded)	55 feet 9 inches
Depth of hold	38 feet 2 inches
Draft (load)	26 feet 9 inches
Tonnage (gross)	8,226
Indicated horsepower	4,000
Speed (knots)	13
Passenger capacity (1st class)	115
Passenger capacity (3d class and steerage)	1,572
Complement (officers and crew)	179
Number of holds, 4; capacity in cubic feet	364,838

The vessel is fitted with two triple-expansion, three-cylinder, reciprocating engines, driving twin screws, steam being furnished by four marine type Scotch boilers at a working pressure of 200 pounds. The boilers are operated with coal as fuel and are fitted with the Howden forced draft system. The auxiliary machinery consists of the usual pumps, such as feed, bilge and ballast, fire, ash ejector, and sanitary, one Atlas-Werke evaporating and distilling plant, two 60-kilowatt direct-current generator sets, one auxiliary condenser, one Vulcan-Werke ash hoist engine, one Clayton system disinfecting machine, and one Atlas-Werke main and one auxiliary steering

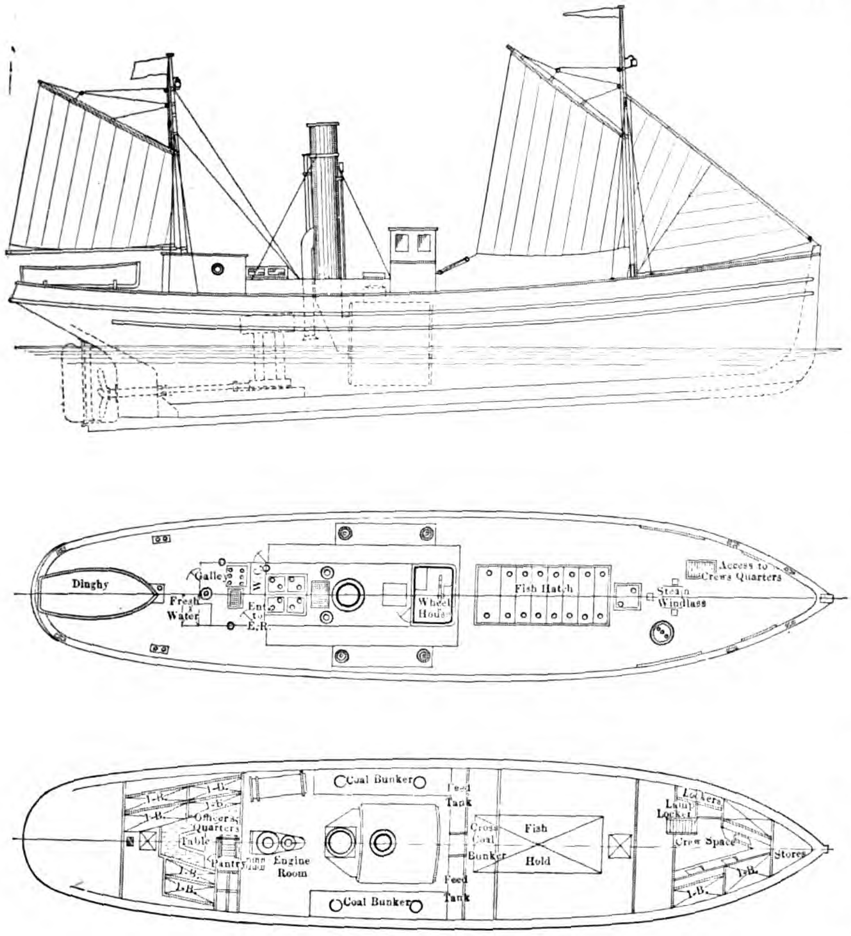


Fig. 6.—Single Screw Wooden Drifter

engine, fitted with a telemotor control gear operated from the bridge.

When this vessel was towed into Balboa by the dredge *Culebra*, which had been dispatched to Peru for this purpose, she was in a very dilapidated and crippled condition, due to her long internment and to destruction wrought by the German crew. Practically no work of repairs had been carried on after Germany's declaration of war, leaving the hull in very poor condition and badly corroded.

Destruction of the Machinery

The destruction of the main and auxiliary machinery was carried out in a most systematic and thorough manner by her former operators. The cylinders of the propelling engines were badly damaged by explosives; the main valves, air pump gear and other miscellaneous brasses and fittings were dismantled and thrown overboard. Important and essential castings of the auxiliary machinery suffered a similar fate by sledge, or could not be accounted for. Especial care was taken to destroy or remove such parts as would render extensive design work necessary for their replacement.

Damage to the Boilers

Water had been removed from the main boilers and fires burned in the furnaces to their full capacity in an endeavor to destroy them. Complete destruction was only prevented by the presence of superheating tubes with which the boilers' flues were fitted. All furnace fittings, however, were destroyed; riveted joints, boiler stays and tubes damaged.

As microscopic, physical and chemical tests on various specimens of boiler plate showed the steel still to be of good quality and unaffected by the heat, the boilers were rebuilt, using new rivets, stays and tubes. The furnace fittings were readily replaced by the Canal foundry. Stacks, uptake, and forced draft duct repairs proceeded simultaneously with those of the boilers. The complete equipment was then lowered in the ship by the crane *Ajax*. As hydrostatic and steam tests of the completed boiler plant indicated excellent workmanship, no delay was experienced in placing the entire machinery department under steam.

Cylinders Patched and Welded

Patches in the meantime had been fitted to the main engine cylinders to replace parts broken, missing or broken beyond repair. Cast iron liners were then inserted in the cylinders to take the pressure strains in the cylinder barrels; damaged ribs and flanges were built up by the electric welding process and machined so that when finished the cylinders were substantially repaired and in serviceable condition.

With the designing of the missing parts, renewing parts from samples and repairing castings by electric and acetylene welding processes, the vessel, taken in a wrecked condition, was repaired and turned over to the United States Shipping Board, equal in all respects to her original design. This work represented approximately 400 separate jobs, all completed within six months after her arrival at the Balboa shops.—*The Panama Canal Record.*

Motorship Being Converted Into Steamship

The *Glenpool*, formerly the German motorship *Hagen*, is being converted to steam power for the Standard Oil Company of New Jersey at the Mariners Harbor yard of the Staten Island Shipbuilding Company, Staten Island, N. Y. This vessel, as originally built in 1912 at the Fried. Krupp A. G. Germania shipyard for the German-American Petroleum Company, was described on page 207 of the May, 1913, issue of Marine Engineering. The vessel is 400 feet long between perpendiculars, 53 feet molded beam, 32 feet 4 inches depth at side to upper deck, and has a net tonnage of 3,087, a gross tonnage of 5,459, and a deadweight tonnage at summer freeboard of 8,200 tons. Power was formerly supplied by two single-acting, two-cycle Diesel engines capable of developing about 1,500 horsepower each at 140 revolutions per minute, giving the vessel a speed of 11 knots at full load. The new machinery, which has been built by the Staten Island Shipbuilding Company, consists of three single-ended Scotch boilers fitted with Howden's system of mechanical heated draft, two triple-expansion engines capable of developing 1,200 indicated horsepower each at 100 revolutions per minute when supplied with steam at 190 pounds per square inch, and the necessary auxiliaries.

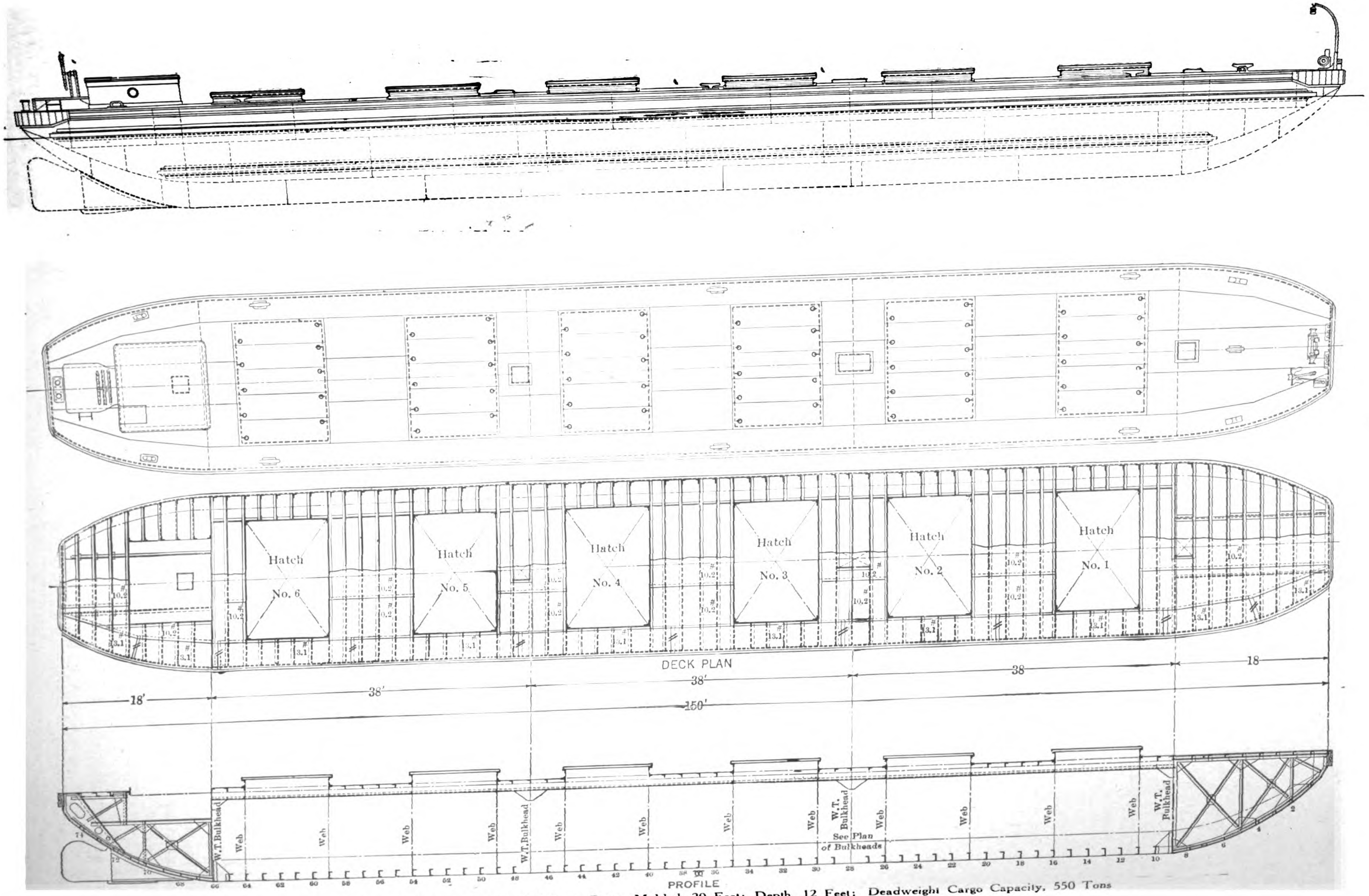

Hatch No. 6
Hatch No. 5
Hatch No. 4
Hatch No. 3
Hatch No. 2
Hatch No. 1
DECK PLAN
18'
38'
38'
38
18
150'
W.T. Bulkhead
Web
W.T. Bulkhead
See Plan of Bulkheads
PROFILE

Fig. 1.—Steel Canal Barge: Length, 150 Feet; Beam, Molded, 20 Feet; Depth, 12 Feet; Deadweight Cargo Capacity, 550 Tons

Large Programme of River and Canal Vessel Construction Now Under Way

MESSRS. COX & STEVENS, naval architects, New York, report that at the present time their organization is largely occupied in connection with the Railroad Administration programme covering towboats, self-propelling barges and cargo barges for the various inland waterways.

The following statement covers the various types of vessels now actually under construction, together with the number now under construction of each type, with the builder's name in each case:

150-Foot Canal Barge
(150 feet by 20 feet by 12 feet)

Railroad Administration for New York Barge Canal

	Barges
Dravo Construction Company, Pittsburgh, Pa..........	12
Ferguson Iron & Steel Company, Buffalo, N. Y........	16
Terry & Tench, New York City......................	20
Downing Marine Construction Company, Glen Cove, N.Y.	3
	51

Tunnel Stern River Towboats
(200 feet by 40 feet by 6 feet)

Railroad Administration for Mississippi River

	Boats
Marietta Mfg. Company, Point Pleasant, W. Va.......	4
Charles Ward Engineering Company, Charleston, W. Va.	2
	6

Canal and Harbor Steel Barge
(230 feet by 45 feet by 11 feet)

Railroad Administration for Lower Mississippi

	Barges
American Bridge Company, Pittsburgh, Pa............	25
Dravo Construction Company, Pittsburgh, Pa..........	15
	40

Tunnel Stern River Towboat
(140 feet by 24 feet by 6 feet)

Railroad Administration for Warrior River

	Boats
Howard Ship Yards & Dock Company, Jeffersonville, Ind.	3

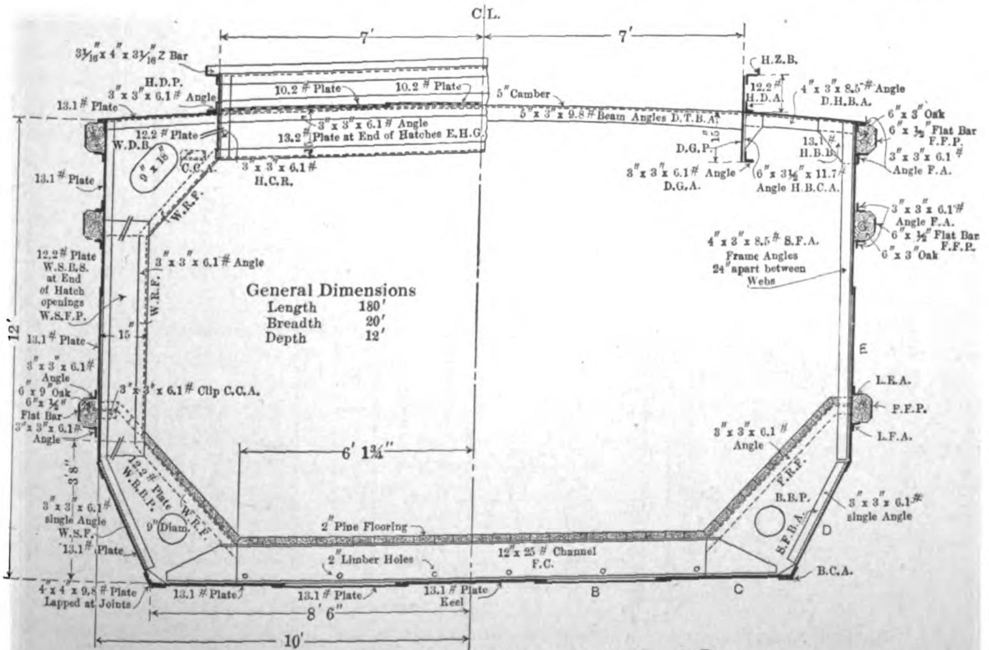

C.L.
7'
7'
3 5/16" x 4" x 3 5/16" Z Bar
H.D.P.
3" x 3" x 6.1# Angle
13.1# Plate
10.2# Plate
10.2# Plate
5" Camber
3" x 3" x 6.1# Angle
13.2# Plate at End of Hatches E.H.G.
5" x 3" x 9.8# Beam Angles D.T.B.A.
12.2# Plate
W.D.B.
9" x 16"
C.C.A.
3" x 3" x 6.1# H.C.R.
W.R.F.
13.1# Plate
12.2# Plate W.S.B.S. at End of Hatch openings W.S.F.P.
3" x 3" x 6.1# Angle
W.R.F.
General Dimensions
Length 180'
Breadth 20'
Depth 12'
12'
15"
13.1# Plate
3" x 3" x 6.1# Angle
6" x 9" Oak
6" x ½" Flat Bar
3" x 3" x 6.1# Angle
3" x 3" x 6.1# Clip C.C.A.
3'8"
6' 1¾"
12.2# Plate W.R.B.P.
W.R.F.
3" x 3" x 6.1# single Angle W.S.F.
9" Diam.
13.1# Plate
2" Pine Flooring
2" Limber Holes
12" x 25# Channel F.C.
4" x 4" x 9.8# Plate Lapped at Joints
13.1# Plate
13.1# Plate
13.1# Plate Keel
8' 6"
10'
B
C
H.Z.B.
12.2# H.D.A.
4" x 3" x 8.5# Angle D.H.B.A.
15"
D.G.P.
3" x 3" x 6.1# Angle D.G.A.
13.1# H.B.B.
6" x 3½" x 11.7# Angle H.B.C.A.
6" x 3" Oak
6" x ½" Flat Bar F.F.P.
3" x 3" x 6.1# Angle F.A.
3" x 3" x 6.1# Angle F.A.
6" x ½" Flat Bar F.F.P.
6" x 3" Oak
4" x 3" x 8.5# S.F.A. Frame Angles 24" apart between Webs
E
L.E.A.
F.F.P.
L.F.A.
3" x 3" x 6.1# Angle
F.R.F.
B.B.P.
S.F.B.A.
3" x 3" x 6.1# single Angle
D
B.C.A.

Fig. 2.—Midship Section of 150-Foot Steel Canal Barge

Steel Self-Propelled Barge
(280 feet by 49 feet by 10 feet)

Railroad Administration for Warrior River, etc.

	Boats
St. Louis Boat & Engineering Company, St. Louis, Mo.	4

Steel Self-Propelled Cargo Barge
(149 feet 6 inches by 20 feet by 12 feet)

Railroad Administration for New York Barge Canal

	Barges
Terry & Tench, New York City........................	12
Dravo Contracting Company, Pittsburgh, Pa...........	4
Starr & Bennett, Newberne, N. C......................	4
	20

All of these vessels were designed by Cox & Stevens and are being built under their supervision.

150-Foot Steel Canal Barges

The general particulars of the 150-foot steel canal barges are as follows:

Length inside fenders	150 feet
Beam, molded	20 feet
Depth	12 feet
Draft, light—	
Forward	27½ inches
Aft	30 inches
Displacement, light	155 tons
Displacement on 9-foot draft	705 tons
Deadweight cargo	550 tons

These vessels are to be square-ended barges with rounded ends, as shown on the plans (Fig. 1), with a slight sheer at the ends to take up the camber of the beams.

The bilge is cut away as shown on the midship section (Fig. 2). The barges are divided into five compartments by four watertight transverse bulkheads and have three cargo holds with two hatches for each hold. The ends are hung from the end bulkheads by lattice girders as shown on plans. There is a skeg at the after end, to which the rudder is attached, operated by hand gear.

The accommodations for the crew are arranged for in a house at the after end of the barge.

These barges are constructed throughout of steel, the details of the construction having been carefully developed so as to produce a light and serviceable hull. Especial attention is paid to the necessary protecting fenders, and the hull throughout is rigid and sufficiently strong to stand the usage to which these barges will be put.

The hatches, of which there are six in all, are as large as possible, being 14 feet wide by 10 feet in length, with combings and tight covers. Ceiling of 2-inch pine is worked in

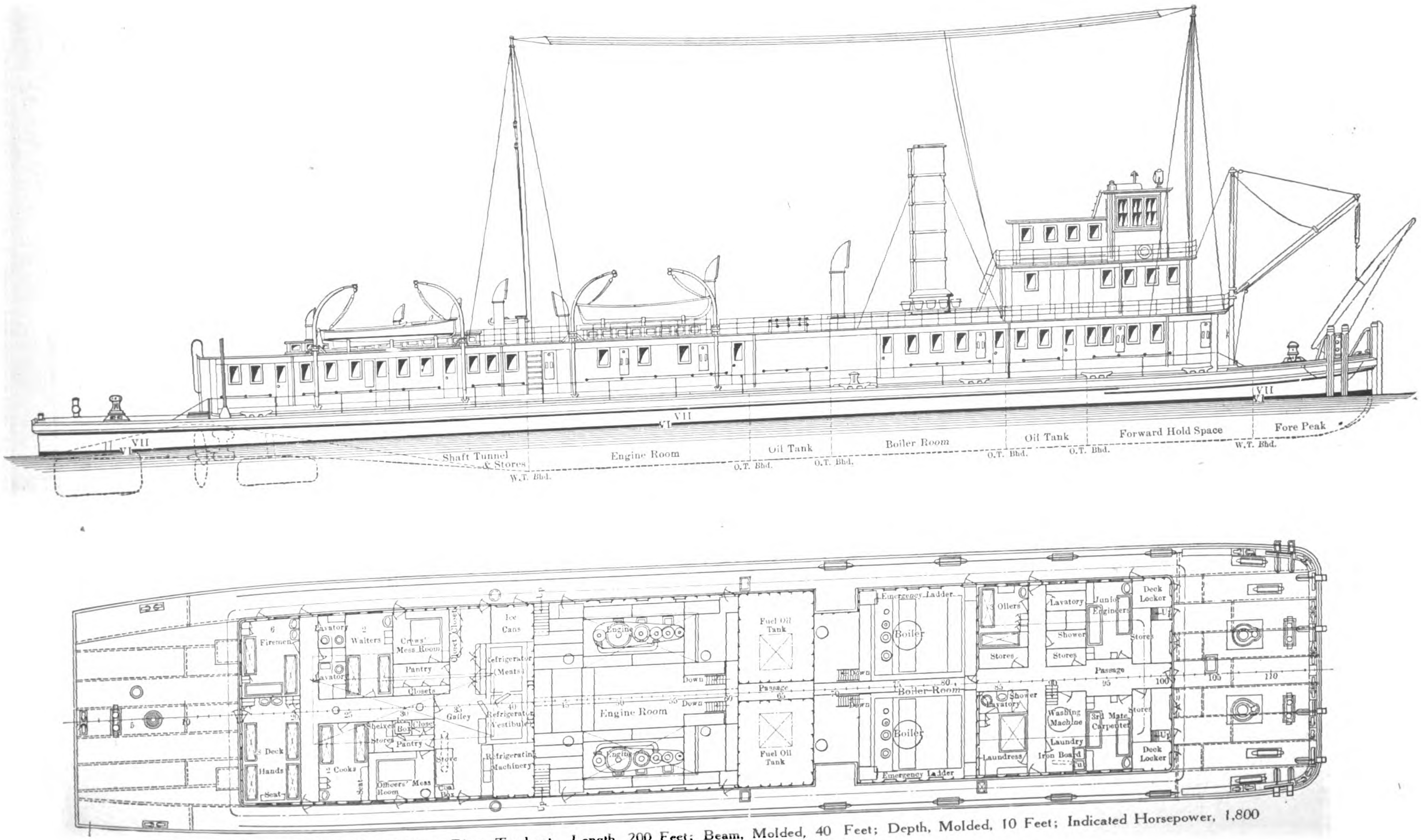

VII
VI
Shaft Tunnel & Stores
W.T. Bhd.
Engine Room
O.T. Bhd.
Oil Tank
O.T. Bhd.
Boiler Room
O.T. Bhd.
Oil Tank
O.T. Bhd.
Forward Hold Space
W.T. Bhd.
Fore Peak
6 Firemen
Lavatory
2 Walters
Crews' Mess Room
Pantry
Closets
Lavatory
Ice Cans
Refrigerator (Meats)
Refrigerator Vestibule
Refrigerating Machinery
Galley
Shelves Stores
Ice Box
Closet
Pantry
Store
Officers' Mess Room
2 Cooks
Deck Hands
Seat
Engine
Engine Room
Engine
Down
Down
Fuel Oil Tank
Passage
Fuel Oil Tank
Emergency Ladder
Boiler
Boiler Room
Boiler
Emergency Ladder
Oilers
Stores
Lavatory
Shower
Stores
Junior Engineers
Deck Locker
Stores
Passage
Shower
Lavatory
Washing Machine
3rd Mate Carpenter
Laundress
Laundry
Iron Board
Stores
Deck Locker
Up
5
10
25
30
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110

Fig. 3.—Twin-Screw Steel, Tunnel Stern River Towboat. Length, 200 Feet; Beam, Molded, 40 Feet; Depth, Molded, 10 Feet; Indicated Horsepower, 1,800

the holds and carried up on the faces of the bilge brackets.

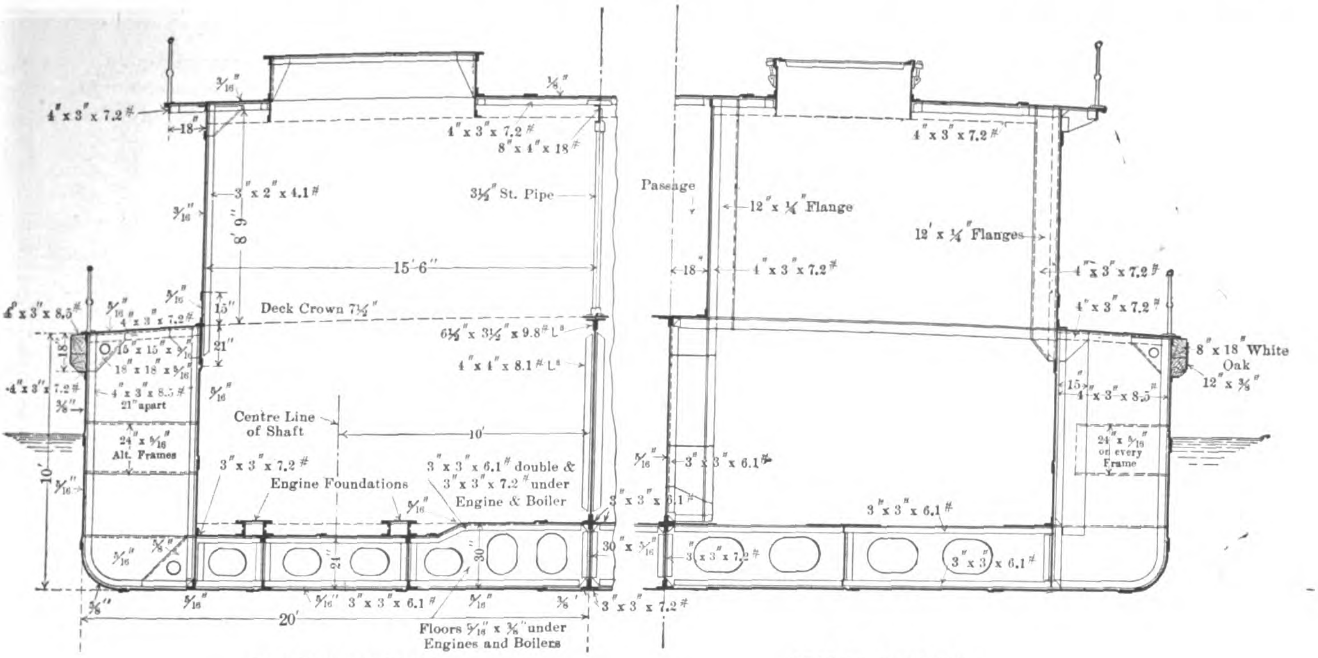
Fifty-one of these barges are now under construction, and in addition a number of similar barges with propelling machinery are being built.

200-Foot Twin-Screw Steel Tunnel Towboats

The 200-foot twin-screw steel tunnel towboats which Cox & Stevens designed for service on the Mississippi River have the following general dimensions:

Length overall	200 feet
Beam, molded	40 feet
Depth, molded	10 feet
Draft	6 feet

These are single-deck vessels fitted with a continuous deck house about 150 feet long, an upper deck house about 30 feet long, and a pilot house above the upper house about 20 feet long. The main deck house is arranged to accommodate the crew, oilers and firemen, stewards' department, galley, mess-rooms, laundry, lavatories, fuel tanks and machinery spaces. The upper house accommodates the pilot, wireless operator and equipment, engineers, spare rooms, lavatories, officers' saloon and deck lockers. The forward part of pilot house is raised to give the helmsman a clear view in all directions. This house affords accommodations for the captain's stateroom, with enclosed stairs to the lower house.


4"x 3"x 7.2#
3/16"
1/8"
18"
4"x 3"x 7.2#
8"x 4"x 18#
3"x 2"x 4.1#
3½" St. Pipe
3/16"
8'9"
15'6"
5/16"
4"x 3"x 8.5#
5/16"
4"x 3"x 7.2#
15"
Deck Crown 7½"
6½"x 3½"x 9.8# L^s
18"
15"x 15"x 5/16"
18"x 18"x 5/16"
21"
4"x 4"x 8.1# L^s
4"x 3"x 7.2#
4"x 3"x 8.5#
21" apart
3/8"
5/16"
Centre Line of Shaft
24"x 5/16"
Alt. Frames
10'
10'
3"x 3"x 7.2#
3"x 3"x 6.1# double & 3"x 3"x 7.2# under Engine & Boiler
Engine Foundations
5/16"
5/16"
5/16"
5/8"
21"
30"
5/8"
5/16"
5/16" 3"x 3"x 6.1#
5/16"
3/8'
20'
Floors 5/16" x 3/8" under Engines and Boilers
30"x 5/16"
3"x 3"x 7.2#
Passage
12"x 1/4" Flange
4"x 3"x 7.2#
12'x 1/4" Flanges
18"
4"x 3"x 7.2#
4"x 3"x 7.2#
4"x 3"x 7.2#
8"x 18" White Oak
12"x 3/8"
15"
4"x 3"x 8.5"
24"x 5/16" on every Frame
5/16"
3"x 3"x 6.1#
3"x 3"x 6.1#
3"x 3"x 6.1#
3"x 3"x 7.2#
3"x 3"x 6.1#

SECTION THROUGH ENGINE ROOM

SECTION THROUGH OIL TANK

Fig. 4.—Midship Section of 200-Foot River Towboat

There are two masts to carry wireless antennae and two small derrick masts forward, together with capstans and heavy bitts and cleats, so located as to facilitate the handling of barges in all positions. The principal towing arrangement is by means of a steel bridle and traveling hook fitted on the upper deck and supported from the after engine room bulkhead by I-beams.

A double bottom is fitted under the engine and boiler rooms for carrying 100 tons of fresh water. Oil fuel is carried in tank compartments located one between the engine and boiler rooms extending to the upper deck and one forward of the boiler room extending to the main deck. The total fuel capacity is about 335 tons.

The vessel is built of steel, all structural material being to the requirements of the American Bureau of Shipping. The general scantlings are shown in the midship section (Fig. 4). Special attention has been given to the arrangement of watertight bulkheads in order to give the vessel the best protection in case of damage from "snags," barges or otherwise. For ease in handling, four rudders are provided in accordance with the best practice for this class of work.

The lines have been developed from an exhaustive study of the type necessary to meet the peculiar conditions of this service, and show a flat section with slightly rounded bilges worked into an easy forebody, and tunnel arrangements aft as clearly shown in the after section (Fig. 3). The sheer is flat, except at the ends.

Special fenders are rigged at the bow to give a bearing for pushing barges either light or loaded without danger of their ends fouling under the overhanging deck of the towboat.

The power plant consists of two triple-expansion engines with cylinders 15½ inches by 25 inches by 44 inches and 26 inches stroke, developing about 900 indicated horsepower each. They are to operate condensing with one surface condenser of 2,400 square feet of cooling surface. Steam is furnished at 250 pounds per square inch working pressure by two watertube boilers, oil-fired, having a total heating surface of about 8,000 square feet, and the usual auxiliaries, all independent, are provided.

Two generating sets of 10 and 5 kilowatts respectively, direct-connected, steam-driven, operating at 80 pounds steam pressure, non-condensing, supply electric current at 110 volts for lighting the vessel and for the wireless set, which has a radius of about 600 miles.

230-Foot Steel Cargo Barges

For service on the Mississippi River the firm of Cox & Stevens has also designed a number of steel cargo barges of the following dimensions:

Length on deck	230 feet
Beam, molded	45 feet
Depth, molded	11 feet
Length of cargo box	184 feet
Width of cargo box	37 feet

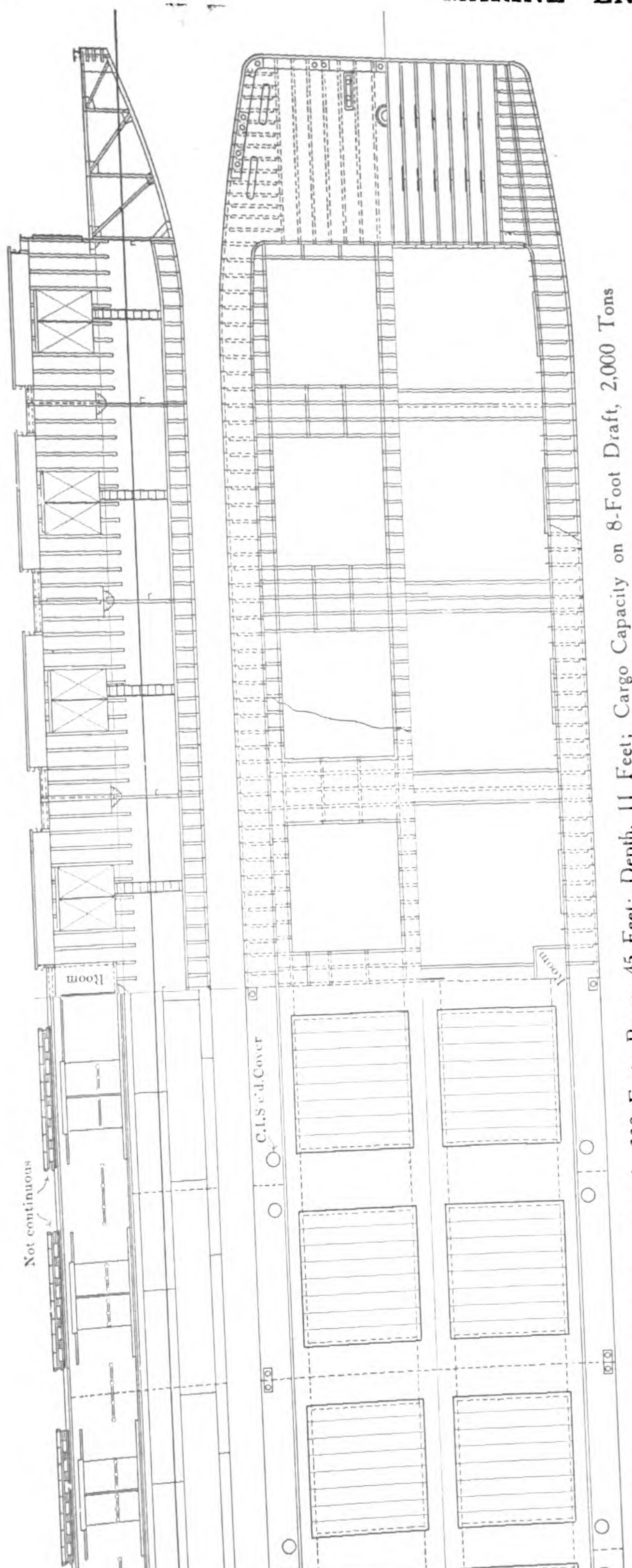


Fig. 5.—Mississippi River Steel Cargo Barge. Length, 230 Feet; Beam, 45 Feet; Depth, 11 Feet; Cargo Capacity on 8-Foot Draft, 2,000 Tons

These barges are designed to carry miscellaneous cargo and bulk oil between St. Louis and New Orleans, or elsewhere, as may be desired, and have a capacity of 2,000 tons of freight on a draft of 8 feet. It is intended that barges of this type will be towed in groups of six by twin-screw tunnel towboats of the type previously described.

The barges are of steel throughout, designed to meet the requirements of the American Bureau of Shipping. The lines show a scow form with long easy raking ends and rounded bilges, designed to reduce resistance in towing upstream in the swift river currents.

The cargo box is provided with sixteen hatches, eight to the side 14 feet by 16 feet, and eight double sliding doors in each side, all arranged for convenience in handling freight. The available cargo space extends from the deck of the cargo box to the floor of the hold, a total depth of 19 feet.

The hold is divided into eighteen compartments by wing and transverse bulkheads, the wing compartments being oil-tight. Pumping arrangements are provided for handling bulk cargo.

140-Foot Tunnel Stern Towboats

A smaller tunnel stern towboat has also been designed by Cox & Stevens for service on the Warrior River. These vessels have the following general dimensions:

Length overall	140 feet
Beam, molded	24 feet
Depth, molded	8 feet 7 inches
Draft, maximum	6 feet

They are of the single-deck type and are fitted with a continuous deck house 112 feet in length running the full length, leaving only room at each end for handling lines, etc.

The forward house contains quarters for engineers, pilots, watchmen and part of the crew, while the after end of the deck house contains the mess room for the white crew, galley stores, quarters and mess room for the colored crew.

The upper house is arranged to accommodate the captain, and the pilot house is fitted with the usual equipment. The pilot house is arranged to give the helmsman a clear view in all directions and is fitted with a powerful searchlight for use in river work at night.

On deck are arranged the necessary number of heavy capstan bitts, cleats and chocks for handling barges in all positions. Especial attention has been paid to the ventilation of the living quarters, so that the crew may at all times be comfortable.

The motive power consists of two triple-expansion engines 10¾ inches, 17 inches and 27 inches diameter by 18 inches stroke, developing 400 horsepower at 200 revolutions per minute. Steam is supplied by two Ward boilers arranged to burn coal as fuel. The machinery plant has been laid out with great care to secure maximum efficiency, and the equipment of auxiliaries is complete in every respect.

The quarters are steam heated, and a generator of 10 kilowatts capacity serves to light the quarters throughout and also supplies current for the searchlight.

For ease in handling, these vessels are equipped with four rudders, two for each shaft, one forward and one aft of the propeller. This arrangement of rudders, in conjunction with tunnel stern construction, has proved particularly satisfactory.

The midship section (Fig. 8) indicates the general type of construction, which is as simple as possible, so as to reduce first cost, particular attention being given to the longitudinal stiffness of the hull, which is arranged by stanchions and diagonal braces in line with the deck

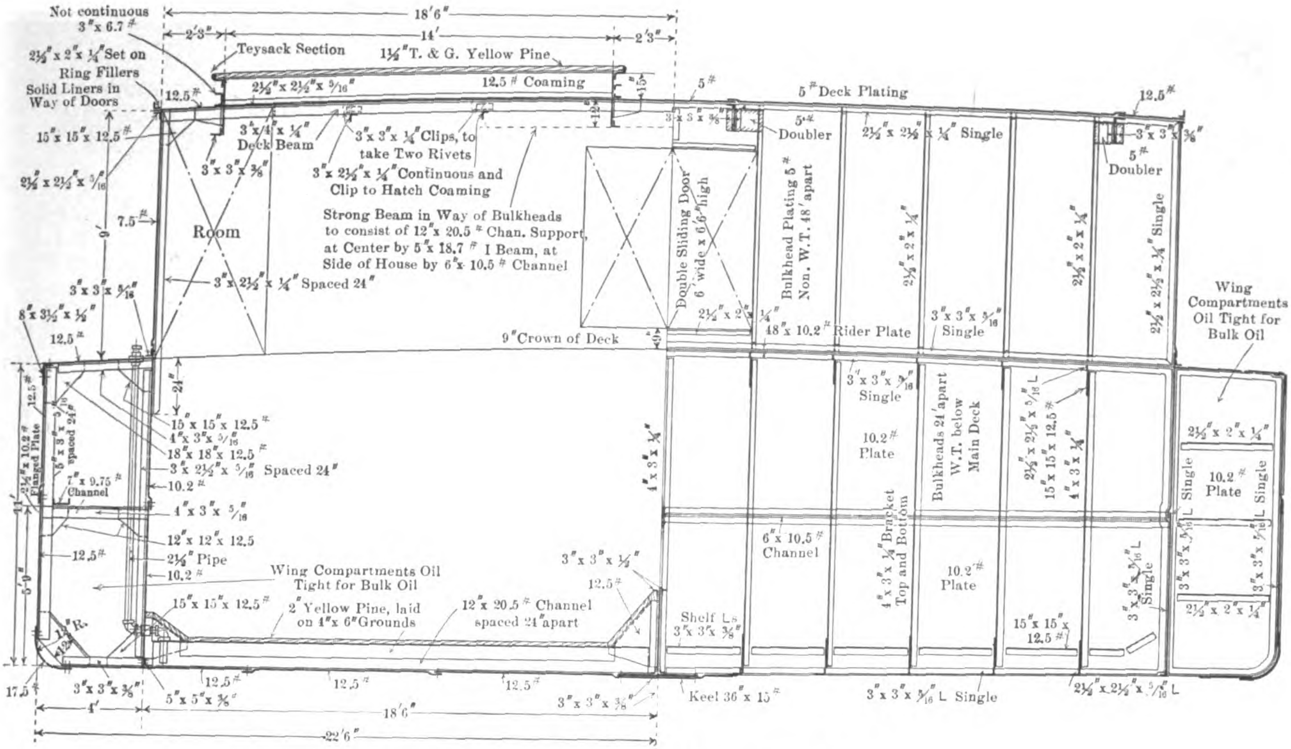

Not continuous 3″x 6.7#
2½″x 2″x ¼″ Set on Ring Fillers
Solid Liners in Way of Doors
15″x 15″x 12.5#
2½″x 2½″x 5/16″
7.5#
9′
3″x 3″x 5/16″
8″x 3½″x ½″
12.5#
18′6″
2′3″
14′
2′3″
Teysack Section
1½″ T. & G. Yellow Pine
12.5#
2½″x 2½″x 5/16″
12.5# Coaming
15″
12″
3″x 4″x ¼″ Deck Beam
3″x 3″x ⅜″
3″x 3″x ¼″ Clips, to take Two Rivets
3″x 2½″x ¼″ Continuous and Clip to Hatch Coaming
Strong Beam in Way of Bulkheads to consist of 12″x 20.5# Chan. Support, at Center by 5″x 18.7# I Beam, at Side of House by 6″x 10.5# Channel
Room
3″x 2½″x ¼″ Spaced 24″
9″ Crown of Deck
Double Sliding Door 6′ wide x 6′6″ high
5#
5# Deck Plating
5# Doubler
2½″x 2½″x ¼″ Single
Bulkhead Plating 5# Non. W.T. 48′ apart
2½″x 2″x ¼″
2½″x 2″x ¼″
48″x 10.2# Rider Plate
3″x 3″x 5/16″ Single
2½″x 2″x ¼″
2½″x 2½″x ¼″ Single
12.5#
3″x 3″x ⅜″
5# Doubler
Wing Compartments Oil Tight for Bulk Oil
12.5#
2½″x 10.2# Flanged Plate
5″x 3″x 5/16″ spaced 24″
7″x 9.75# Channel
24″
15″x 15″x 12.5#
4″x 3″x 5/16″
18″x 18″x 12.5#
3″x 2½″x 5/16″ Spaced 24″
10.2#
4″x 3″x 5/16″
12″x 12″x 12.5
12.5#
2½″ Pipe
10.2#
11′
5′-9″
Wing Compartments Oil Tight for Bulk Oil
15″x 15″x 12.5#
2″ Yellow Pine, laid on 4″x 6″ Grounds
12″x 20.5# Channel spaced 24″ apart
3″x 3″x ½″
12.5#
12″R.
12″
4″x 3″x ¼″
17.5#
3″x 3″x ⅜″
5″x 5″x ⅜″
12.5#
12.5#
12.5#
3″x 3″x ⅜″
4′
18′6″
22′6″
3″x 3″x 5/16″ Single
10.2# Plate
Bulkheads 21′ apart W.T. below Main Deck
2½″x 2½″x 5/16″ L
15″x 15″x 12.5#
4″x 3″x ¼″
2½″x 2″x ¼″
10.2# Plate
3″x 3″x 5/16″ L Single
3″x 3″x 5/16″ L Single
2½″x 2″x ¼″
6″x 10.5# Channel
4″x 3″x ¼″ Bracket Top and Bottom
10.2# Plate
3″x 3″x 5/16″ L Single
Shelf Ls 3″x 3″x ⅜″
15″x 15″x 12.5#
Keel 36″x 15#
3″x 3″x 5/16″ L Single
2½″x 2½″x 5/16″ L

Fig. 6.—Midship Section of 230-Foot Cargo Barge

house side. The construction of the vessel in way of the propeller, showing the details of the tunnel, is especially interesting. Heavy oak fender strips are run along each side, with steel facing plates to protect the hull of the vessel from damage.

280-FOOT TWIN-SCREW TUNNEL STERN SELF-PROPELLED BARGES

For service on the Tombigbee, Alabama and Black Warrior rivers, Messrs. Cox & Stevens have also designed a self-propelled barge of the following dimensions:

Length overall	280 feet
Beam, molded	49 feet
Depth, molded	10 feet
Draft, maximum	7 feet

The hull shows the usual barge section, with bows shaped slightly for easy entrance and with two tunnels aft. Cargo is carried on the main deck. An open cargo box somewhat forward of midships provides for 1,600 tons of coal. At each end of the coal box are enclosures for package freight, the forward enclosure being 24 feet long, provided with two hatches 12 feet by 16 feet in the top and a sliding door in each side. The after enclosure is

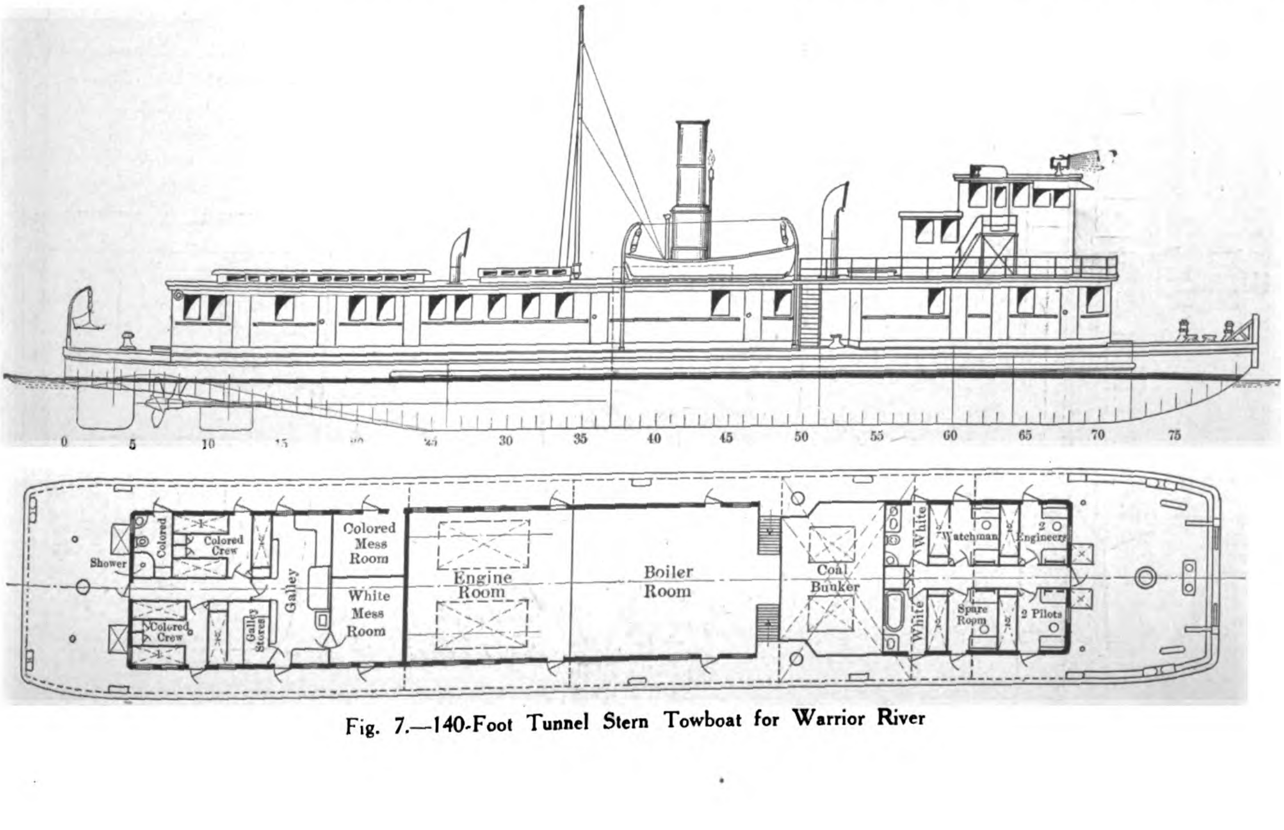

0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
Shower
Colored
Colored Crew
Colored Crew
Galley
Galley Stores
Colored Mess Room
White Mess Room
Engine Room
Boiler Room
Coal Bunker
White
Watchman
2 Engineers
White
Spare Room
2 Pilots

Fig. 7.—140-Foot Tunnel Stern Towboat for Warrior River

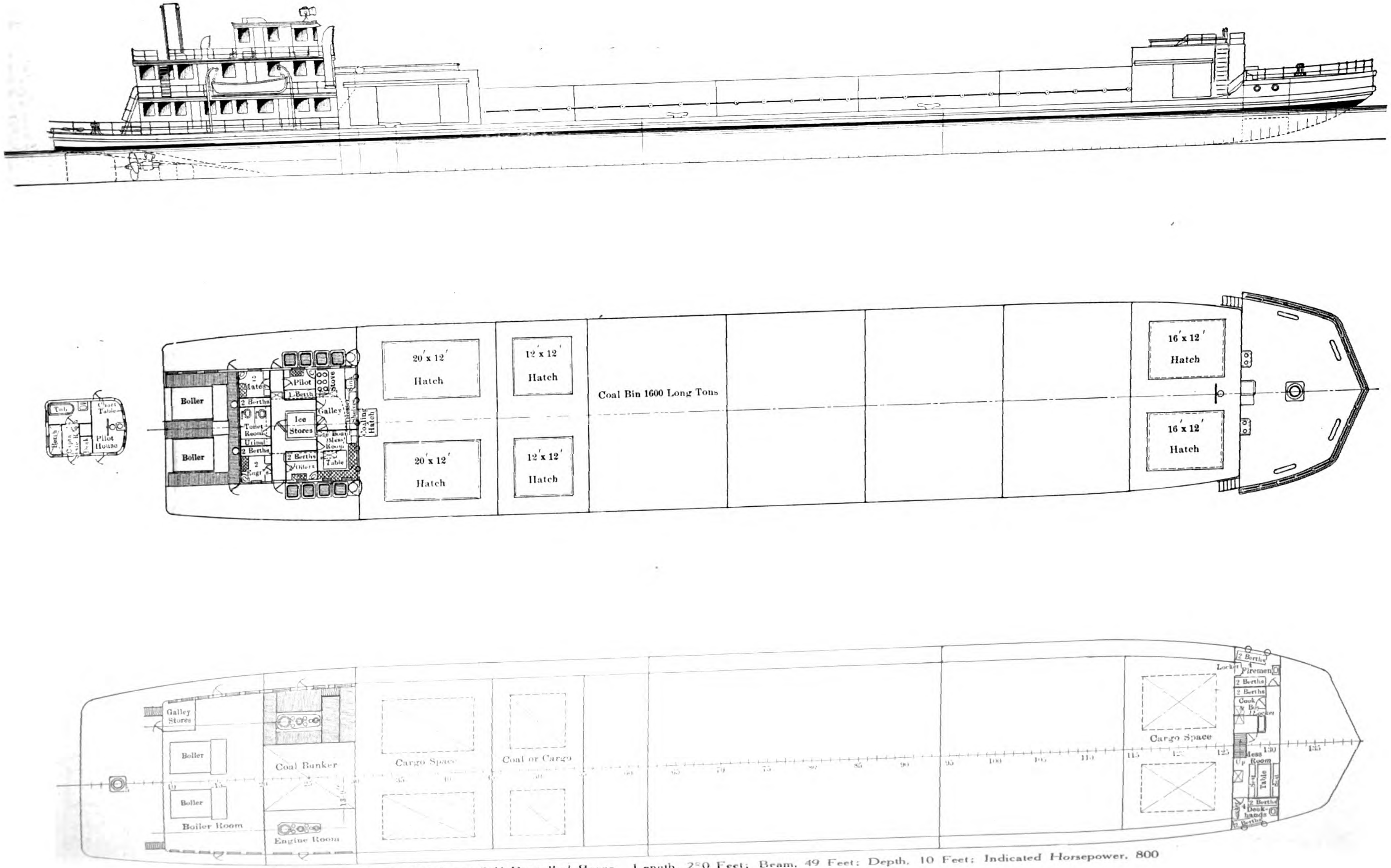

Boiler
Boiler
2 Mates
Pilot
1-Berth
Stove
2 Berths
Toilet Room
Urinal
2 Berths
2 Engr
Ice Stores
Galley
Coaling Hatch
Mess Room
Table
2 Berths Oilers
Tub
Chart Table
Pilot House
Berth
20'x12' Hatch
20'x12' Hatch
12'x12' Hatch
12'x12' Hatch
Coal Bin 1600 Long Tons
16'x12' Hatch
16'x12' Hatch
Galley Stores
Boiler
Boiler
Boiler Room
Coal Bunker
Engine Room
Cargo Space
Coal or Cargo
Cargo Space
Locker
2 Berths 4 Firemen
2 Berths
2 Berths
Cook & Boy
Locker
Mess Room
Up
Table
2 Berths Deck hands

Fig. 8. Twin-Screw, Tunnel Stern Self-Propelled Barge. Length, 250 Feet; Beam, 49 Feet; Depth, 10 Feet; Indicated Horsepower, 800

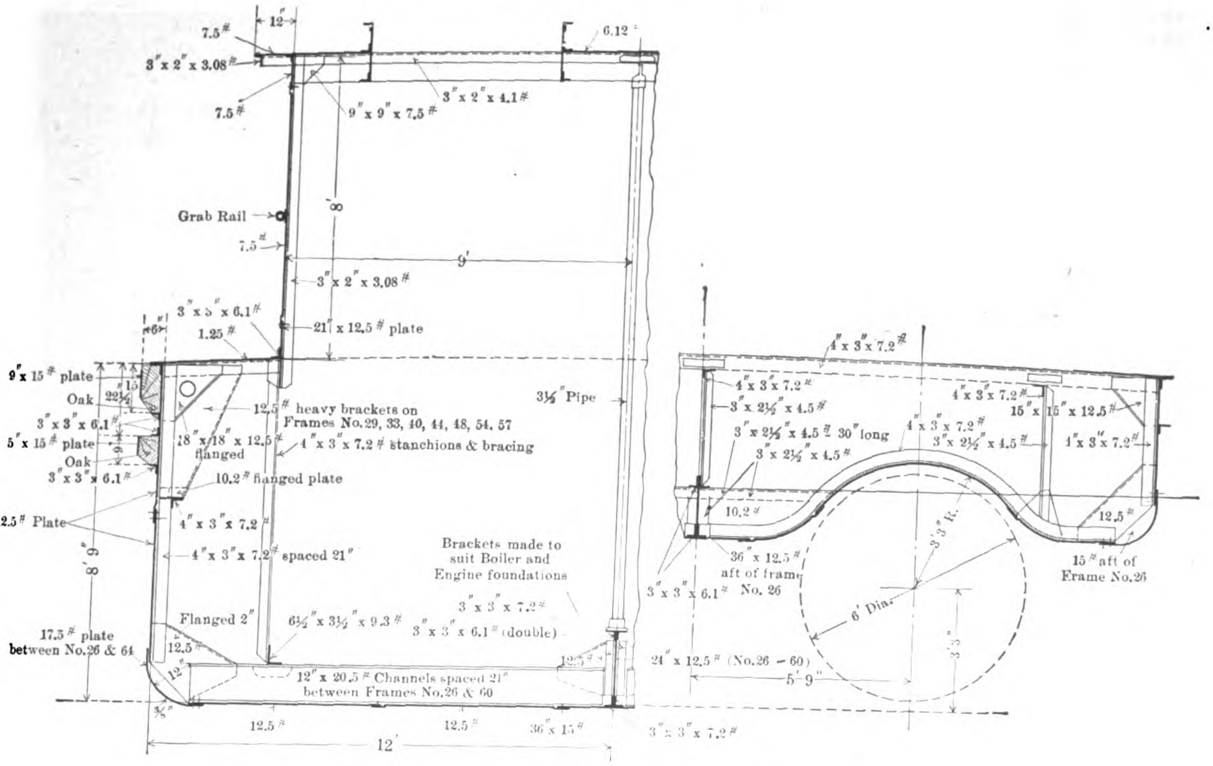

12"
7.5#
3"x 2" x 3.08#
7.5#
9" x 9" x 7.5#
3" x 2" x 4.1#
6.12#
8'
Grab Rail
7.5#
9'
3" x 2" x 3.08#
3" x 5" x 6.1#
6"
1.25#
21" x 12.5# plate
9" x 15# plate
Oak 22½
15
3" x 3" x 6.1#
5" x 15# plate
Oak
3" x 3" x 6.1#
12.5# heavy brackets on Frames No. 29, 33, 40, 44, 48, 54, 57
18" x 18" x 12.5# flanged
4" x 3" x 7.2# stanchions & bracing
10.2# flanged plate
3½" Pipe
12.5# Plate
8'-6"
4" x 3" x 7.2#
4" x 3" x 7.2# spaced 21"
Brackets made to suit Boiler and Engine foundations
3" x 3" x 7.2#
Flanged 2"
6½" x 3½" x 9.3#
3" x 3" x 6.1# (double)
17.5# plate between No. 26 & 64
12.5#
12" x 20.5# Channels spaced 21" between Frames No. 26 & 60
⅜"
12.5#
12.5#
36" x 15#
12'
4" x 3" x 7.2#
4" x 3" x 7.2#
3" x 2½" x 4.5#
3" x 2½" x 4.5# 30" long
3" x 2½" x 4.5#
4" x 3" x 7.2#
4" x 3" x 7.2#
3" x 2½" x 4.5#
15" x 15" x 12.5#
4" x 3" x 7.2#
10.2#
3'-3" R.
12.5#
36" x 12.5# aft of frame No. 26
3" x 3" x 6.1#
6' Dia.
15# aft of Frame No. 26
21" x 12.5# (No. 26 – 60)
5'-9"
3'-3"
3" x 3" x 7.2#

Fig. 9.—Midship Section of 140-Foot Tunnel Stern Towboat

50 feet long with four hatches, two 12 feet by 12 feet and two 12 feet by 20 feet, and has two doors to each side.

The crew's quarters are forward below deck, with accommodations for four deck hands, four firemen, cook and messman. The engine enclosure and principal quarters are in the after house, as shown in the plan (Fig. 8). The pilot house, with quarters for the captain, is located on top of the upper house.

In the tunnels are four balanced rudders, two on each side, one forward and one aft of each propeller. This

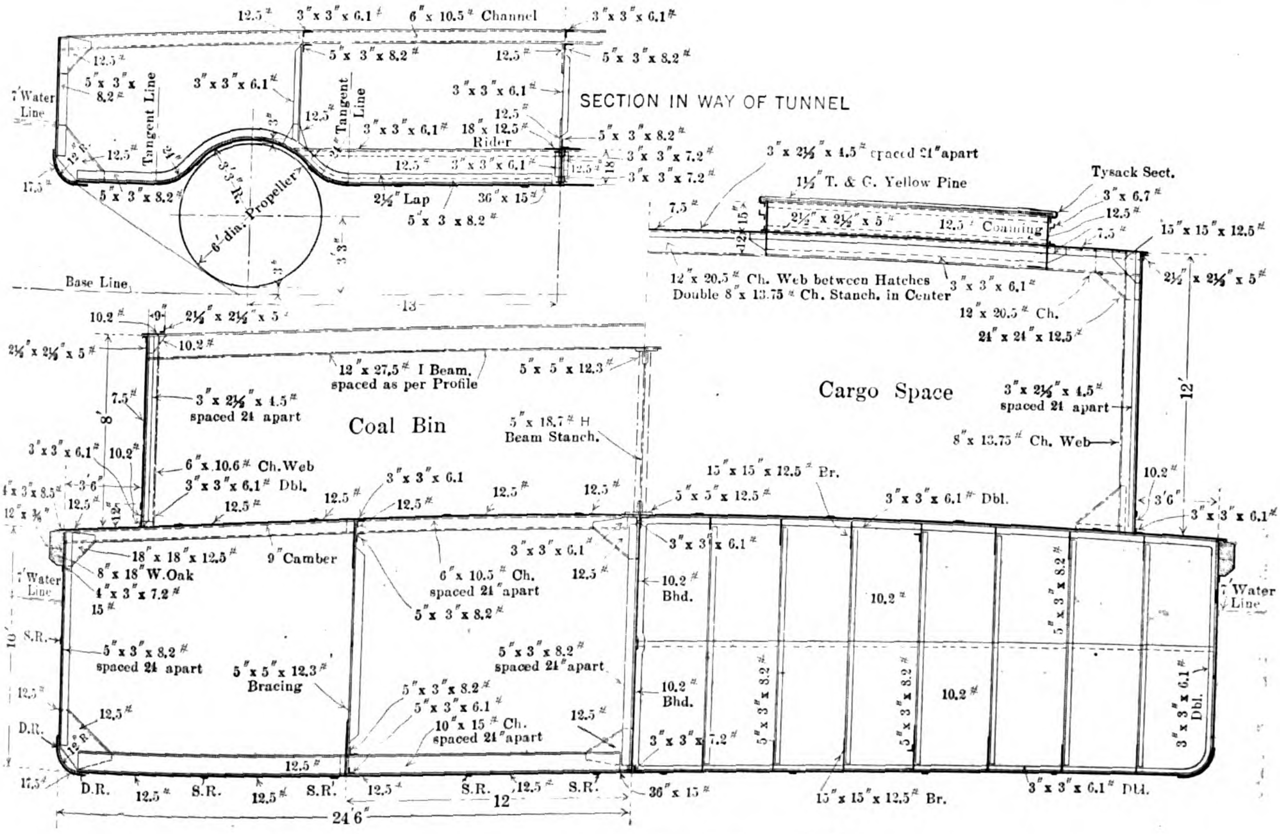

12.5#
3" x 3" x 6.1#
6" x 10.5# Channel
3" x 3" x 6.1#
12.5#
5" x 3" x 8.2#
12.5#
5" x 3" x 8.2#
7' Water Line
5" x 3" x 8.2#
Tangent Line
3" x 3" x 6.1#
3" x 3" x 6.1#
Tangent Line
SECTION IN WAY OF TUNNEL
3" x 3" x 6.1#
18" x 12.5# Rider
12.5#
5" x 3" x 8.2#
3" x 3" x 7.2#
3" x 3" x 7.2#
12.5#
3" x 3" x 6.1#
17.5#
5" x 3" x 8.2#
3'-3" R.
6' dia. Propeller
2½" Lap
36" x 15#
5" x 3" x 8.2#
Base Line
13'
3" x 2½" x 4.5# spaced 21" apart
1¼" T. & G. Yellow Pine
Tysack Sect.
3" x 6.7#
12.5#
7.5#
2½" x 2½" x 5#
12.5# Coaming
7.5#
15" x 15" x 12.5#
12" x 20.5# Ch. Web between Hatches Double 8" x 13.75# Ch. Stanch. in Center
3" x 3" x 6.1#
2½" x 2½" x 5#
12" x 20.5# Ch.
24" x 24" x 12.5#
10.2#
2½" x 2½" x 5#
10.2#
2½" x 2½" x 5#
12" x 27.5# I Beam, spaced as per Profile
5" x 5" x 12.3#
7.5#
8'
3" x 2½" x 4.5# spaced 24 apart
Coal Bin
5" x 18.7# H Beam Stanch.
Cargo Space
3" x 2½" x 4.5# spaced 24 apart
12'
8" x 13.75# Ch. Web
3" x 3" x 6.1#
10.2#
6" x 10.6# Ch. Web
3" x 3" x 6.1# Dbl.
3" x 3" x 6.1
4" x 3" x 8.5#
3'-6"
12" x ⅜"
12.5#
12.5#
12.5#
12.5#
12.5#
15" x 15" x 12.5# Br.
5" x 5" x 12.5#
3" x 3" x 6.1# Dbl.
10.2#
3'-6"
3" x 3" x 6.1#
18" x 18" x 12.5#
8" x 18" W. Oak
4" x 3" x 7.2#
15#
9" Camber
3" x 3" x 6.1#
6" x 10.5# Ch. spaced 24" apart
12.5#
3" x 3" x 6.1#
10.2# Bhd.
10.2#
5" x 3" x 8.2#
7' Water Line
5" x 3" x 8.2#
10'
S.R.
5" x 3" x 8.2# spaced 24 apart
5" x 5" x 12.3# Bracing
5" x 3" x 8.2# spaced 24" apart
5" x 3" x 8.2#
5" x 3" x 6.1#
10" x 15# Ch. spaced 24" apart
10.2# Bhd.
5" x 3" x 8.2#
5" x 3" x 8.2#
10.2#
3" x 3" x 6.1# Dbl.
12.5#
D.R.
12.5#
12.5#
3" x 3" x 7.2#
17.5#
D.R.
12.5#
S.R.
12.5#
S.R.
12.5#
S.R.
12.5#
S.R.
12'
36" x 15#
15" x 15" x 12.5# Br.
3" x 3" x 6.1# Dbl.
24'6"

Fig. 10.—Midship Section of 280-Foot Self-Propelled Barge

arrangement is calculated to give the best results when going either ahead or astern. The propellers turn outboard right and left and will give a maximum speed of 8 miles per hour loaded.

The propelling engines consist of two inverted-cylinder triple-expansion engines with cylinders 10¾ inches by 17 inches by 27 inches diameter and 18 inches stroke, designed to operate at a working pressure of 225 pounds and to develop 400 indicated horsepower at 200 revolutions per minute. The engines are provided with one surface condenser of 1,100 square feet cooling surface, an independent air pump and a centrifugal circulating pump.

The boilers are of marine watertube type, two in number, each to have approximately 1,400 square feet heating surface and 39 square feet grate surface, arranged for bituminous coal, hand-fired, natural draft.

The generating set is of 7½ kilowatts 110 volts, direct-connected to vertical steam engine, to operate at 80 pounds steam pressure.

These vessels, as well as the others, were designed in accordance with the requirements of the American Bureau of Shipping. Taken altogether, these boats represent a distinct advance in the design of floating equipment for river and canal service, and their performance in service will be watched with interest.

Production Speed—Oxy-Acetylene Cutting One Answer[*]

BY R. R. BROWNING[†]

With the inauguration of submarine warfare by Germany, it became immediately apparent to the American shipbuilding industry that steel ships, without number, would be required. The oxy-acetylene cutting process, which, since its introduction into this country, has been used by the steel shipbuilder, was one of the first processes to be called upon to speed up production in old as well as in new shipyards. The development of the application in the shipyards occasioned by the demand for more ships was a matter given special attention by the welding committee of the United States Emergency Fleet Corporation, by the American Bureau of Shipping, and by Lloyds. The result was the application of the process to such important work as the following:

- Cutting or trimming of plates and structural iron to shape;
- Making manholes, portholes, patches, ventilator and funnel openings, stairway openings, mast openings and headlights;
- Trimming stem and stern posts;
- Cutting frames and plates;
- Cutting shafting, pipes, chains, rivets and scrap.

The majority of these applications were made absolutely essential during the war in the speed-up schedule required through the time limit placed on production, a most interesting example being that of cutting portholes.

It has always been customary in shipyards to punch a large number of holes with a ½- or ¾-inch punch around the periphery of the proposed porthole. The central portion, or plate, was in this manner removed and the edges then trimmed by means of a chipping hammer. An average of one and a half hours was required to make in this manner a 12-inch diameter porthole, whereas with an oxy-acetylene circular cutting blowpipe and a simple attachment the portholes were during the war and are now completed in an average time of five minutes each. This not only shows a considerable saving in time and cost in doing the work, but it can also be said that the finished porthole, as made by the oxy-acetylene cutting process, is better in appearance than that of the older process.

New Repair Facilities of the Todd Shipyards Corporation

The shipbuilding and repair facilities of the Todd Shipyards Corporation are well illustrated in the accompanying views of the company's yards on the Atlantic and Pacific. These facilities have recently been effectively increased by the placing in commission of the third section of the 8,800-ton floating dry dock at the plant of the Clinton Dry Docks, Inc., Clinton street, Brooklyn. When the fourth and last section is placed in operation, probably during October, the dock will have an overall length of 428 feet, with a width of 114 feet. The dock can handle vessels up to 500 feet long.

Construction of two piers, one 800 feet long and 125 feet wide, and the other 600 feet long and 150 feet wide,

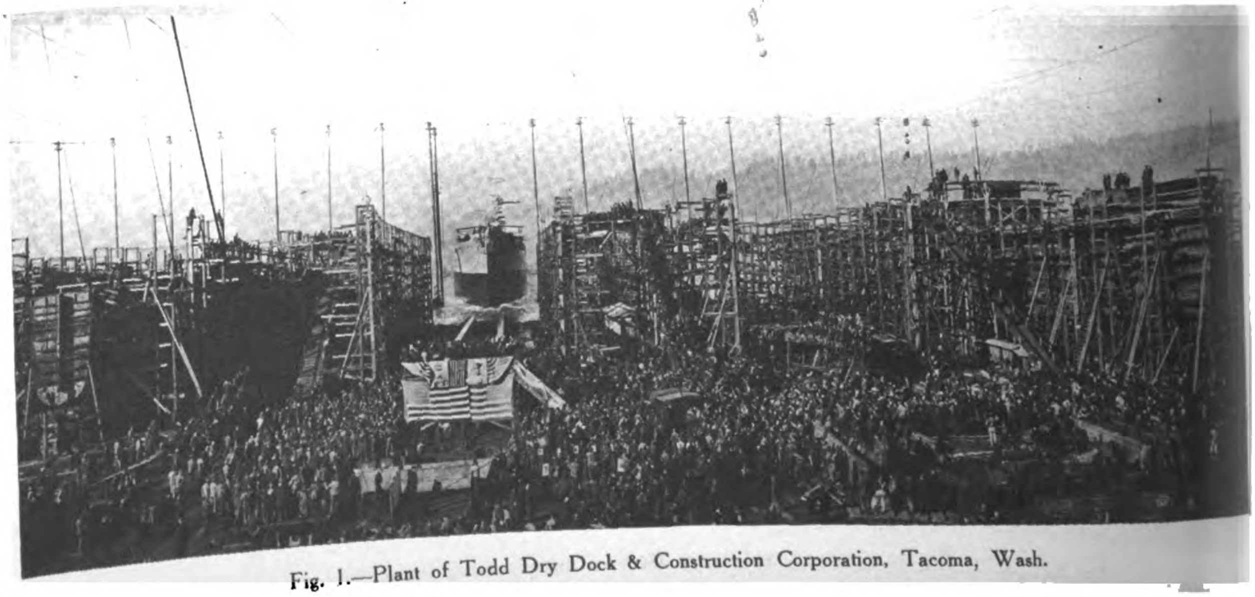


Fig. 1.—Plant of Todd Dry Dock & Construction Corporation, Tacoma, Wash.

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[*] From a paper read before the annual convention of the International Acetylene Association, New York, July 15-17, 1919.

[†] Vice-president, Oxweld Acetylene Company, Chicago, Ill.

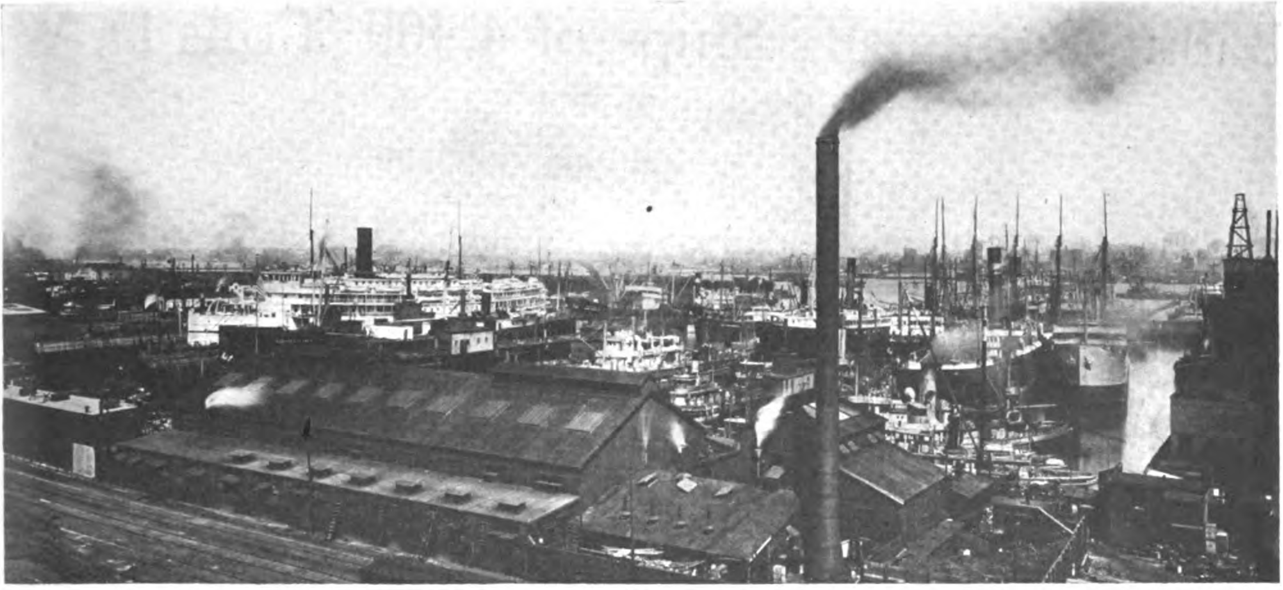


Fig. 2.—Plant of Tietjen & Lang Dry Dock Company, Hoboken, N. J.

is also nearing completion. In the construction of the dry dock it was necessary to dredge to a depth of 37 feet below water level, so that the dock might function effectively. For this reason the pier to which it is moored is especially strong. The construction of the dock, which is equipped with Alberger pumps and driven by General Electric motors, has been carried out by Harry Cossey, Tottenville, S. I.

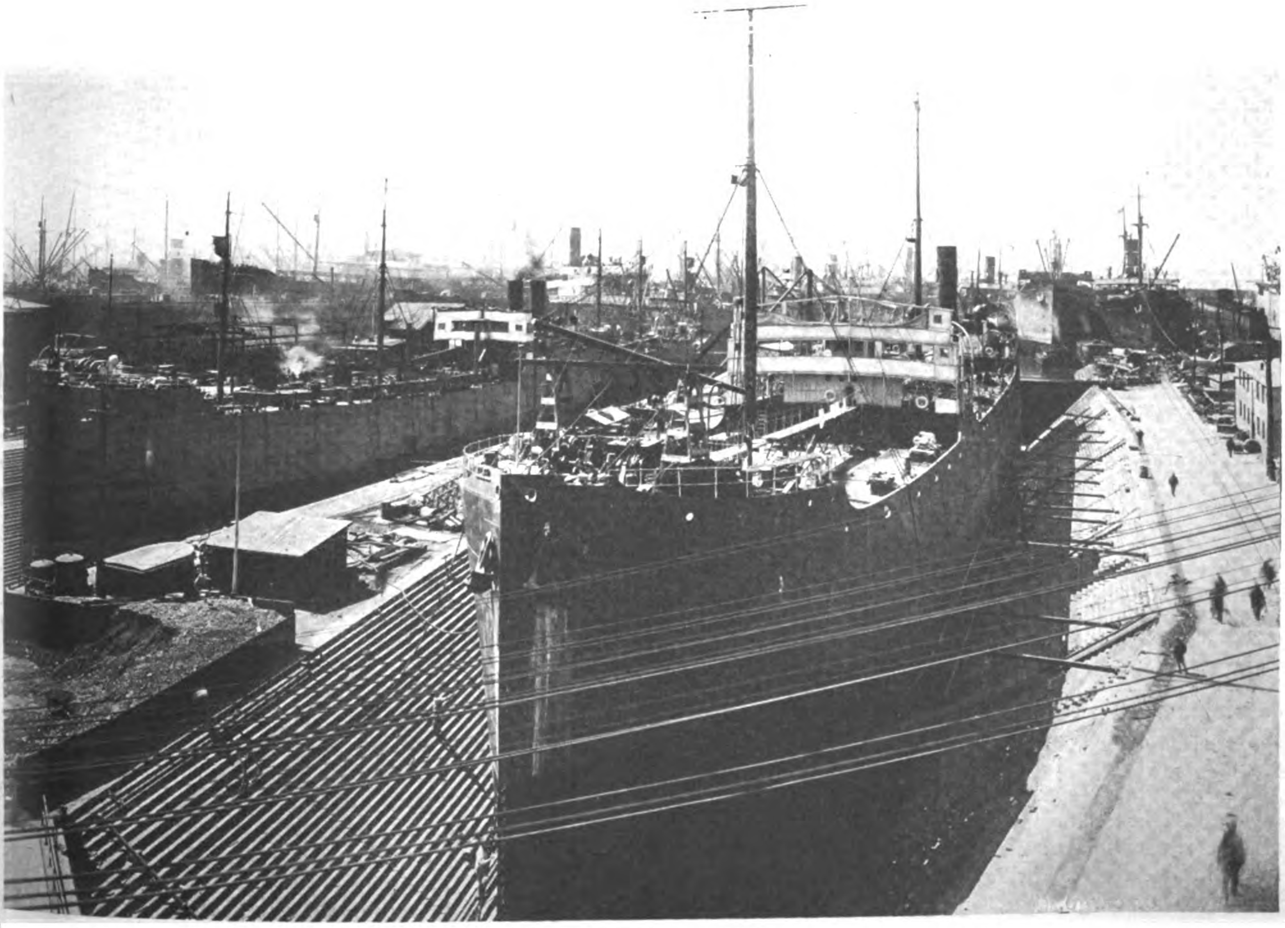


Fig. 3.—Plant of Robins Dry Dock & Repair Company, Erie Basin, Brooklyn

Ballin Composite Ships of 4,400 Tons D. W.

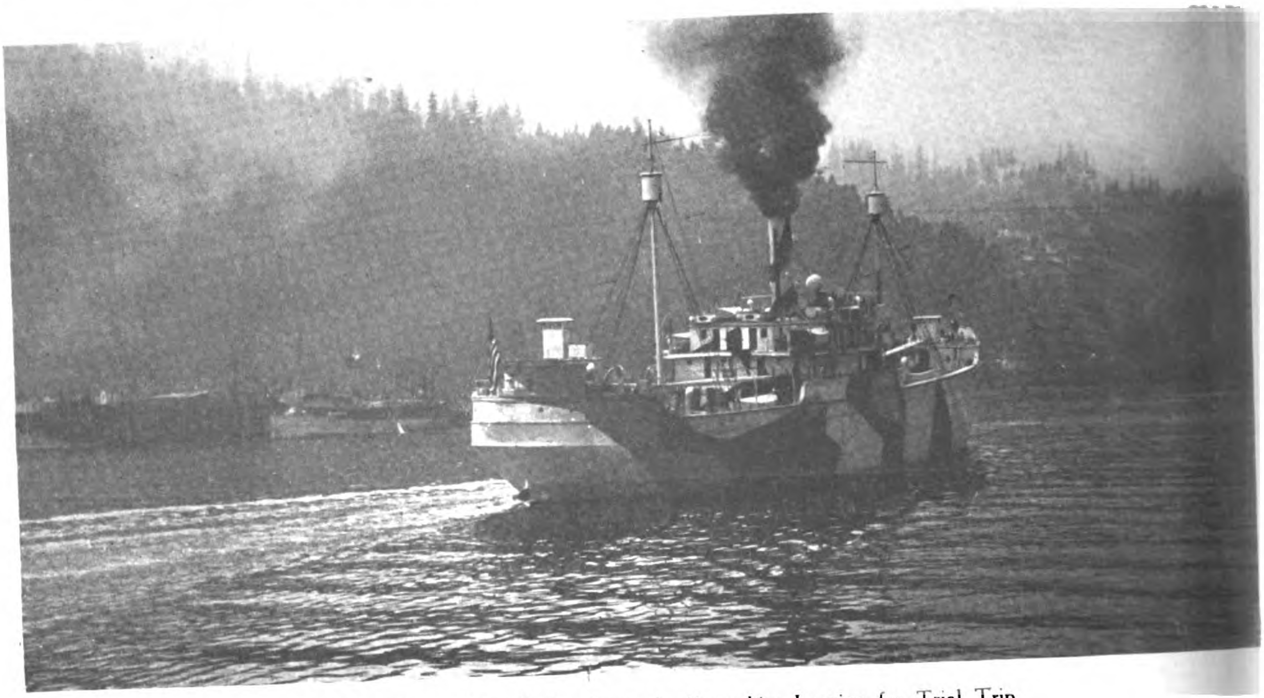


Fig. 1.—One of the Ballin Composite Steamships Leaving for Trial Trip

AMONG the wooden steamships built for the Emergency Fleet Corporation during the war period, eleven of the Ballin composite type were built by the Supple-Ballin Shipbuilding Corporation, Portland, Ore. The outstanding feature of these vessels, in so far as the hulls are concerned, is a steel topside construction in combination with double diagonal planking under a fore and aft course of heavier outside planking, and triple-floored frames, with light topside timbers. The machinery for these vessels, while not only much larger but also of quite a different design from that installed in the standard wooden ship, was built and installed by the Pacific Marine Iron Works, of Portland, Ore.

The hulls are of the following dimensions:

Length overall	307 feet 0 inches
Length between perpendiculars	295 feet 5 inches
Beam, molded at deck	43 feet 0 inches
Breadth, extreme over planking	44 feet 7½ inches
Depth, molded	26 feet 0 inches
Draft, full load	23 feet 2 inches
Speed on trial, mean	12.48 knots
Cubic capacity, bale, about	150,000 cubic feet
Cubic capacity, grain, about	165,000 cubic feet
Deadweight tonnage at load draft	4,400 tons
Coal bunker capacity, permanent, about...	150 tons
Coal bunker reserve, coal or cargo.......	300 tons
Fresh boiler feed water tanks, about.....	74 tons
Fresh culinary water tanks, about.......	25 tons
Gross tonnage	2,799 tons
Net tonnage	1,676 tons

The vessels are of the three island type, with machinery amidship, and are rigged with two masts with four cargo booms on each mast, each of three tons capacity. There are four large cargo hatches.

The machinery space is divided from the cargo holds by watertight bulkheads. The permanent coal bunkers are located abreast of the fireroom, extending from bilge to main deck. The bridge enclosure may be used for either coal or cargo.

The reserve feed is carried in two steel tanks located at the after end of the engine room, and the culinary water in two tanks fixed at the starboard side of the engine room.

Hull Construction

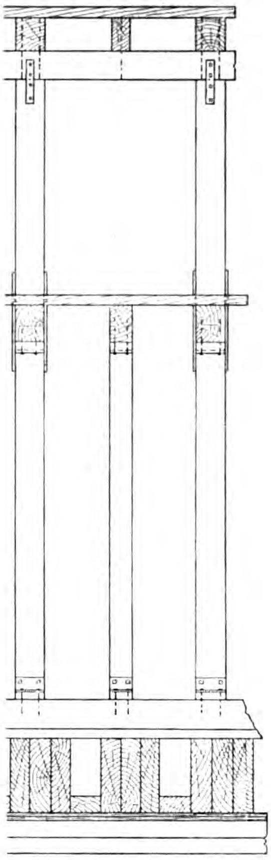
The outstanding feature of the hulls, as previously mentioned, is the steel topside construction in combination with double diagonal planking, under a fore and aft course of heavier outside planking, and triple-floored frames, with light double top timbers.

The floors are molded 30 inches at the keel, 18 inches at the bilge and are triple-sided 7½ inches. The top timbers are molded from 18 inches at the bilge to 12 inches at the main deck and are double-sided 7½ inches. The spacing is 36 inches. This construction affords a maximum of bottom strength with the minimum of weight in the top timbers, the whole being a construction which is justified by rational engineering principles when used in conjunction with the double diagonal sheathing and steel topsides.

The ceiling is about one-half the thickness customarily used in wooden vessels of this size, thereby resulting in a great reduction of weight and some additional cubic capacity.

The steel topsides construction consists essentially in a wide outer or sheer strake, an inner or bulwark plate, a stringer plate and a rail plate, except in way of the bridge erection, where double angles are substituted for the rail plate to preserve the continuity of strength. The various strakes are assembled on a staging, completely riveted and then launched into place. They are fastened to the woodwork and diagonal sheathing with countersunk head screw bolts of ample size and number. The bolts, falling in way of the steel knees, pass through the flanges of same. Those bolts through the stringer have special heads designed to prevent all likelihood of leaks.

Extending diagonally athwartships from stringer to stringer are four sets of diagonal straps, let in flush with the top of the beams. Additional straps are disposed



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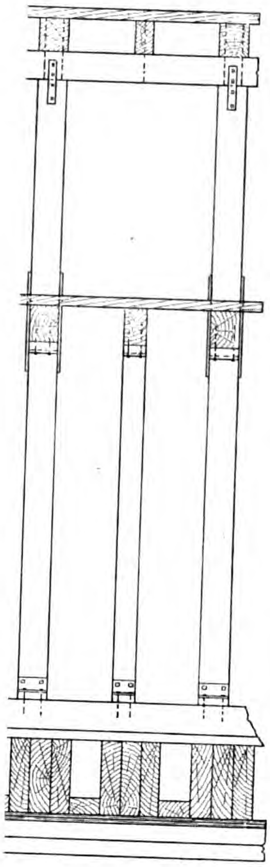

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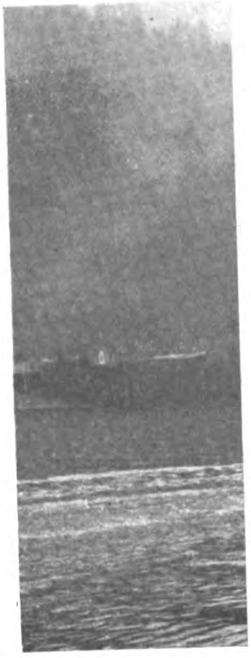

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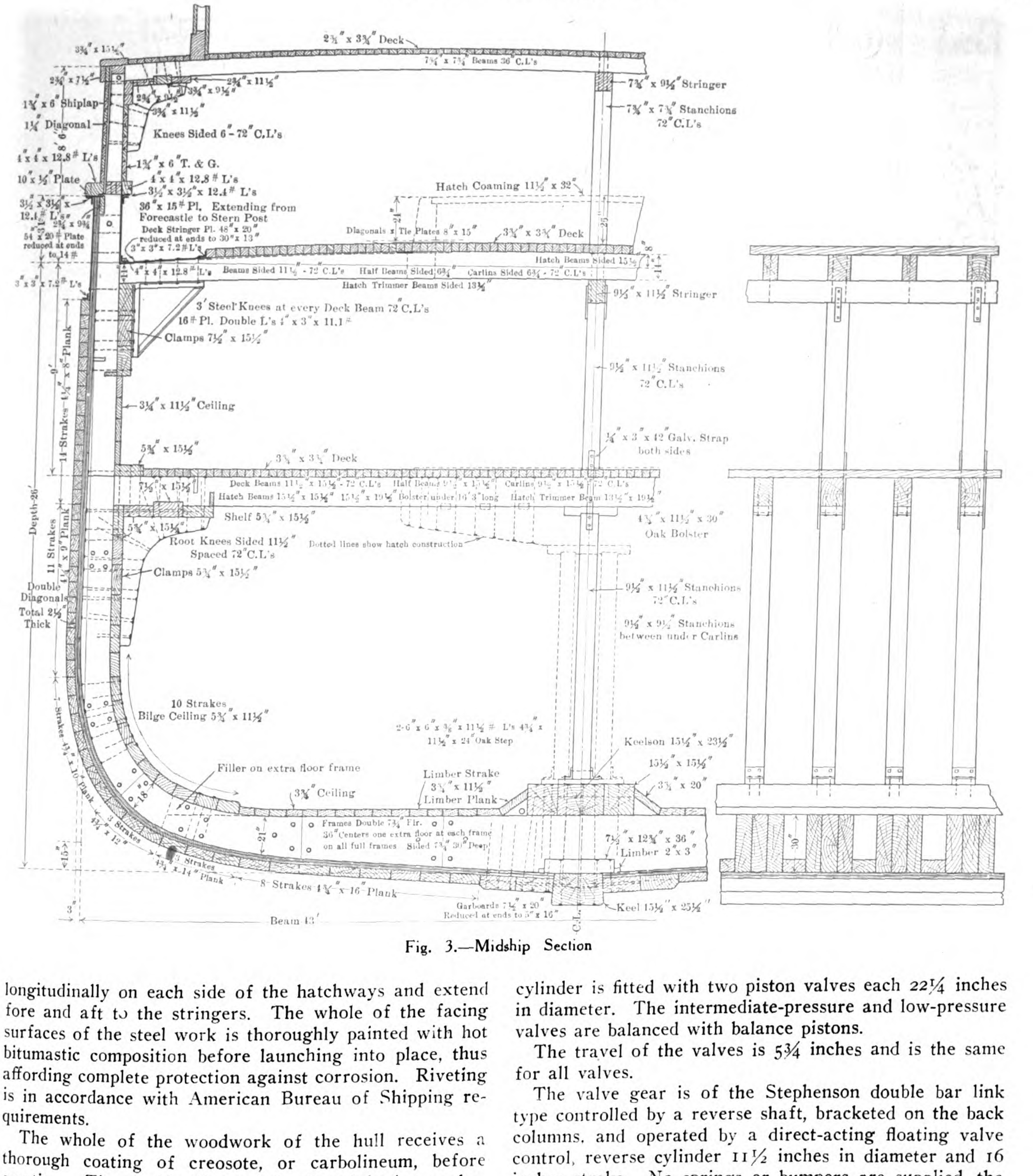
2¾" x 3¾" Deck
7¾" x 7¾" Beams 36" C.L's
3¾" x 15½"
2¾" x 7½"
2¾" x 11½"
3¾" x 9½"
2¾" x 9½"
3¾" x 11½"
1¾" x 6" Shiplap
1¼" Diagonal
Knees Sided 6"-72" C.L's
8' 6"
4" x 4" x 12.8# L's
1¾" x 6" T. & G.
10" x ½" Plate
4" x 4" x 12.8# L's
3½" x 3½" x 12.4# L's
3½" x 3½" x 12.4# L's
2¾" x 9¾
36" x 15# Pl. Extending from Forecastle to Stern Post
Deck Stringer Pl. 48" x 20" reduced at ends to 30" x 13"
54" x 20# Plate reduced at ends to 14#
3" x 3" x 7.2# L's
4" x 4" x 12.8# L's
Beams Sided 11½" - 72" C.L's
Half Beams Sided 6¾"
Carlins Sided 6¾ - 72" C.L's
Hatch Trimmer Beams Sided 13¾"
Hatch Beams Sided 15½
3" x 3" x 7.2# L's
7¾" x 9½" Stringer
7¾" x 7¾" Stanchions 72" C.L's
Hatch Coaming 11½" x 32"
24"
25"
Diagonals & Tie Plates 8" x 15"
3¾" x 3¾" Deck
8"
9½" x 11½" Stringer
3' Steel Knees at every Deck Beam 72" C.L's
16# Pl. Double L's 4" x 3" x 11.1#
Clamps 7½" x 15½"
9½" x 11½" Stanchions 72" C.L's
9'
14-Strakes-4¼" x 8"-Plank
3¼" x 11½" Ceiling
¼" x 3" x 42" Galv. Strap both sides
5¾" x 15½"
3¾" x 3¾" Deck
Deck Beams 11½" x 15½" - 72" C.L's
Half Beams 9½" x 15½"
Carlins 9½" x 15½" - 72" C.L's
7½" x 15½"
Hatch Beams 15½" x 15½"
15½" x 19½" Bolster under 16' 3" long
Hatch Trimmer Beam 13½" x 19½"
Shelf 5¾" x 15½"
4¾" x 11½" x 30" Oak Bolster
5¾" x 15½"
Root Knees Sided 11½" Spaced 72" C.L's
Dotted lines show hatch construction
Depth-26'
11 Strakes 4¼" x 9" Plank
Clamps 5¾" x 15½"
Double Diagonals Total 2½" Thick
9½" x 11½" Stanchions 72" C.L's
9½" x 9½" Stanchions between under Carlins
10 Strakes Bilge Ceiling 5¾" x 11½"
7-Strakes 4¾" x 10" Plank
2-6" x 6" x ⅜" x 11½# L's 4¾" x 11½" x 24" Oak Step
Keelson 15½" x 23½"
15½" x 15½"
Filler on extra floor frame
18"
3¾" Ceiling
Limber Strake 3¾" x 11½"
Limber Plank
3¾" x 20"
3 Strakes 4¾" x 12"
21"
Frames Double 7¾" Fir. 36" Centers one extra floor at each frame on all full frames Sided 7¾" 30" Deep
7½" x 12¾" x 36"
Limber 2" x 3"
15"
3 Strakes 4¾" x 14" Plank
8 Strakes 4¾" x 16" Plank
Garboards 7½" x 20" Reduced at ends to 5" x 16"
Keel 15½" x 25½"
3"
Beam 43'
C.L.
30"

Fig. 3.—Midship Section

longitudinally on each side of the hatchways and extend fore and aft to the stringers. The whole of the facing surfaces of the steel work is thoroughly painted with hot bitumastic composition before launching into place, thus affording complete protection against corrosion. Riveting is in accordance with American Bureau of Shipping requirements.

The whole of the woodwork of the hull receives a thorough coating of creosote, or carbolineum, before erection. The double diagonal is dipped in hot carbolineum. Surfaces exposed during construction are recoated with this preservative. No salt is used.

Propelling Machinery and Auxiliaries

The ship is propelled by a single vertical inverted triple-expansion engine with cylinders 21 inches, 34 inches and 57 inches in diameter with a common stroke of 42 inches, designed for an indicated horsepower of 1,800 at 86 revolutions per minute, and weighs approximately 190,000 pounds complete.

The high-pressure and intermediate-pressure cylinders are each fitted with a single piston valve 10¼ inches in diameter for the high pressure and 19¼ inches in diameter for the intermediate pressure. The low-pressure cylinder is fitted with two piston valves each 22¼ inches in diameter. The intermediate-pressure and low-pressure valves are balanced with balance pistons.

The travel of the valves is 5¾ inches and is the same for all valves.

The valve gear is of the Stephenson double bar link type controlled by a reverse shaft, bracketed on the back columns, and operated by a direct-acting floating valve control, reverse cylinder 11½ inches in diameter and 16 inches stroke. No springs or bumpers are supplied, the cushioning of the reverse piston being effected by special arrangement of the steam ports in the cylinder.

The crank shaft, built up in two sections with a coupling between the intermediate-pressure and low-pressure cranks, is 11¾ inches in diameter in the crank pins and journals. The crank arms are forged steel, shrunk onto the pins and journal sections and keyed. The coupling bolts are 2¾ inches in diameter and parallel.

A 6-inch by 6-inch single-cylinder reversible turning engine is provided and mounted on the starboard thrust block strut.

A direct-connected air pump of the Edwards type, 22 inches in diameter, 18 inches stroke, is mounted on the low-pressure back column and driven off the low-pressure

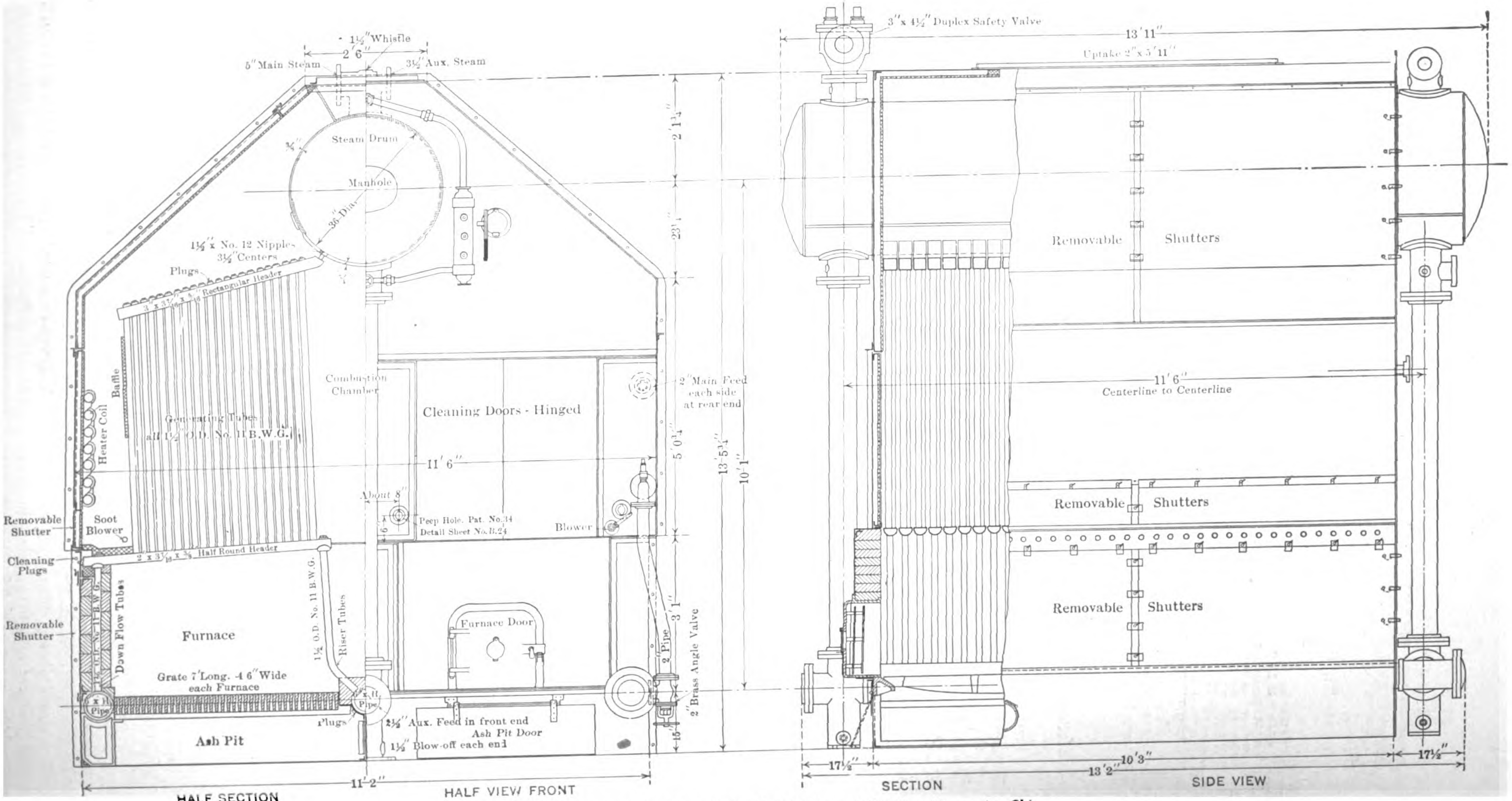
1½″ Whistle
2′ 6″
5″ Main Steam
3½″ Aux. Steam
Steam Drum
Manhole
36″ Dia.
1½″ x No. 12 Nipples 3½″ Centers
Plugs
Rectangular Header
Baffle
Heater Coil
Generating Tubes all 1½″ O.D. No. 11 B.W.G.
Combustion Chamber
Cleaning Doors - Hinged
11′ 6″
About 8″
Peep Hole. Pat. No. 34 Detail Sheet No. B. 24
Blower
2″ Main Feed each side at rear end
2′ 1¼″
23″
5′ 0¾″
3′ 1″
13′ 5¾″
10′ 1″
Removable Shutter
Soot Blower
Cleaning Plugs
Half Round Header
Down Flow Tubes
Furnace
Grate 7′ Long. 4′ 6″ Wide each Furnace
1½″ O.D. No. 11 B.W.G.
Riser Tubes
Furnace Door
2″ Pipe
2″ Brass Angle Valve
Pipe
Plugs
Ash Pit
2½″ Aux. Feed in front end
Ash Pit Door
1½″ Blow-off each end
15″
11′ 2″
HALF SECTION
HALF VIEW FRONT
3″ x 4½″ Duplex Safety Valve
13′ 11″
Uptake 2″ x 5′ 11″
Removable Shutters
11′ 6″ Centerline to Centerline
Removable Shutters
Removable Shutters
17½″
10′ 3″
13′ 2″
17½″
SECTION
SIDE VIEW

Fig. 6.—Ballin Type Watertube Boiler Installed on 4,400-Ton Composite Ship

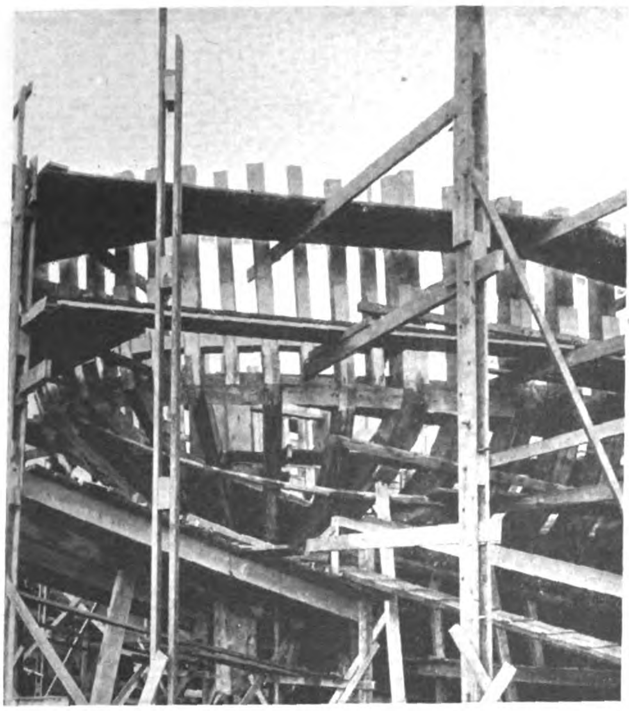

Fig. 7.—Stern Framing

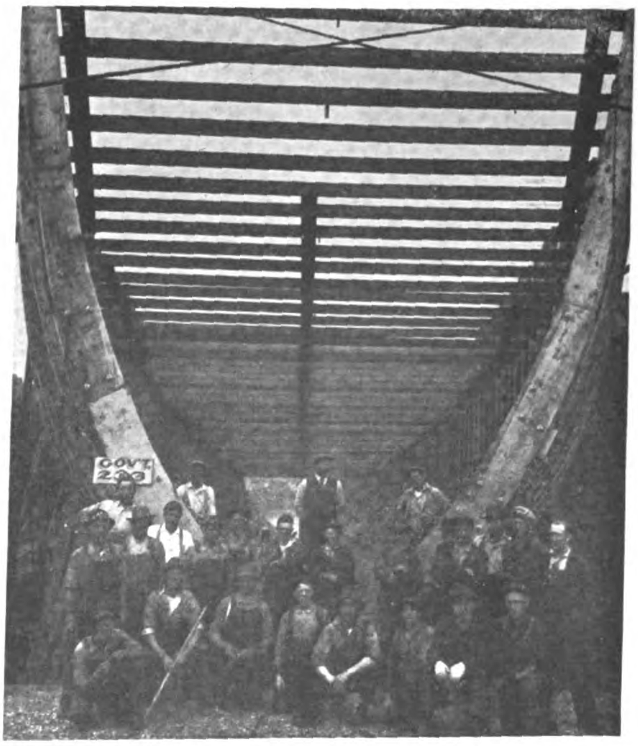

Fig. 8.—Main Framing

crosshead. Two direct-connected bilge pumps are attached to the body of the air pump and driven off the air pump crosshead. They are 3½ inches in diameter.

The thrust bearing is of the horseshoe type with six collars 21 inches in diameter, 2 inches thick. The horseshoes are of cast iron cast hollow for water circulation. The thrust shaft is 11¾ inches in diameter. The intermediate shaft is 11¼ inches in diameter and 80 feet long in four sections of 20 feet each, each section being supported by a single bearing 12 inches long. The propeller shaft is 12½ inches in diameter, 25 feet 8¼ inches long.

The propeller is a right-hand true screw, with four semi-steel blades mounted on a semi-steel hub. The diameter is 14 feet 6 inches, with a pitch of 14 feet. The developed area is 63.4 square feet, the projected area 54.7 square feet, and the ratio of developed area to disk area 1 to .384. Immersion of the upper tip at load draft is about 8 feet 2 inches.

An independent surface condenser is provided, containing 2,500 square feet of cooling surface. The circulating pump is of the centrifugal type with a 10-inch suction and discharge driven by a 9-inch by 9-inch single-cylinder inverted vertical steam engine.

BOILERS

Steam at 200 pounds gage pressure is furnished by two Ballin watertube boilers, arranged for coal firing. Each boiler has a heating surface of 3,500 square feet and a grate surface of 51.17 square feet. Each boiler contains 1,496 tubes having an external diameter of 1½ inches. The area of the smokestack is 23 square feet, and the height above the grate 70 feet. The ability of these boilers to furnish dry steam in ample quantities for the main engine and auxiliaries with natural draft is fully demonstrated by the trial data. No forced draft is installed.

DECK MACHINERY

Cargo is handled by eight 8-inch by 8-inch single-drum spur-geared winches, with direct steam valve control. The windlass is of the spur-geared type with double wildcats and extra large gypsy heads on each side and with engines 8 inches by 10 inches.

The steering engine is of the steam screw type attached to a yoke on the rudder stock, with telemotor control and

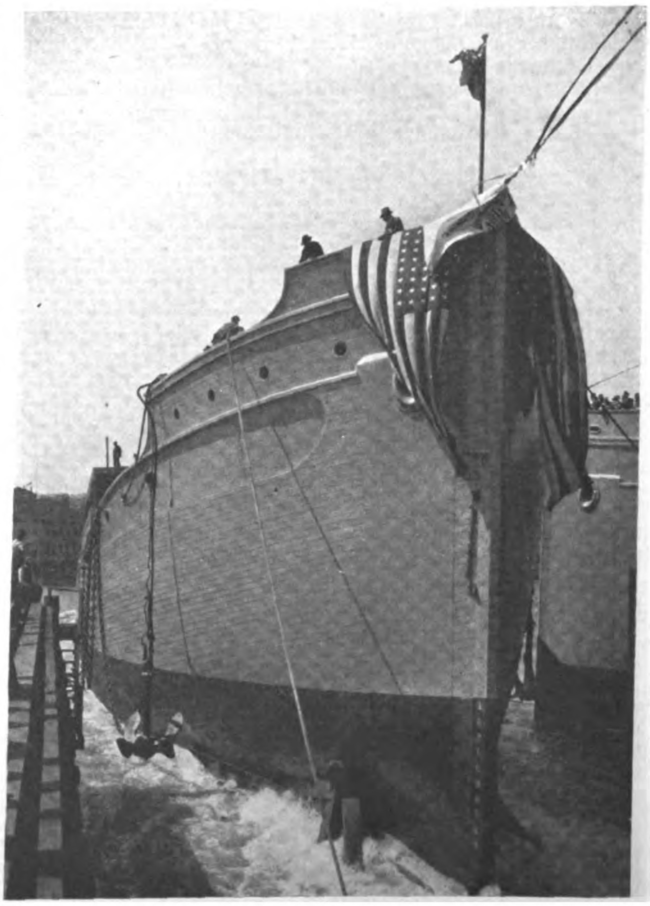

Fig. 9.—Launching of Composite Ship

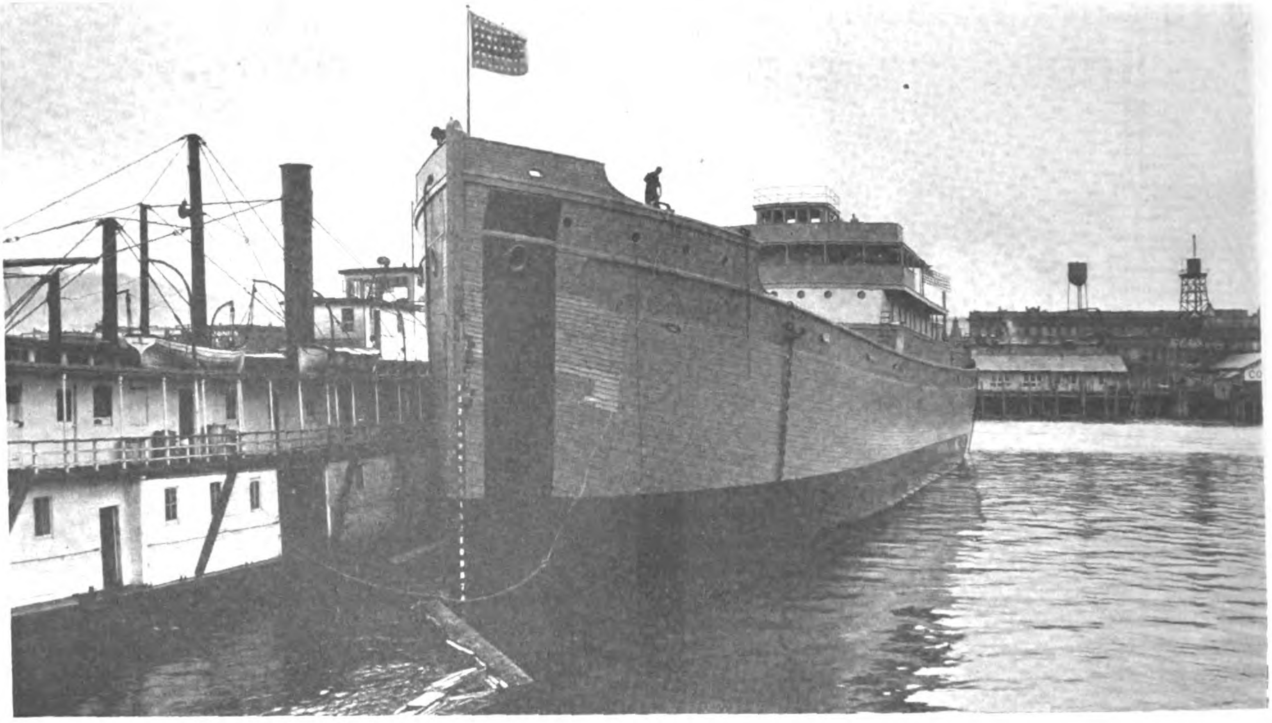

Fig. 10.—Composite Vessel at Fitting-Out Berth

engine 5 inches by 6 inches. A steam warping capstan is located on the poop deck aft.

Auxiliaries

The following pumps and auxiliaries are furnished:

Fire and bilge pump, horizontal duplex, 10 inches by 6 inches by 10 inches.

General service pump, horizontal duplex, 10 inches by 6 inches by 10 inches.

Sanitary pump, horizontal duplex, 6 inches by 6 inches by 6 inches.

Evaporator feed pump, horizontal duplex, 4¾ inches by 2¾ inches by 4½ inches.

Fresh water pump, horizontal duplex, 4¾ inches by 2¾ inches by 4½ inches.

Main feed pump, vertical simplex, 10 inches by 6 inches by 12 inches.

Auxiliary feed pump, vertical simplex, 10 inches by 6 inches by 12 inches.

Ice machine, 1-ton direct ammonia expansion.

Engine generator set, 10 kilowatts; direct-connected engine, 5 inches by 5 inches, 600 revolutions per minute.

Feed water heater, horizontal closed; capacity, 30,000 pounds per hour; 210 to 212 degrees with steam at 5 pounds back pressure.

Evaporator, enclosed coil, 15-ton capacity in 24 hours.

The trial trip data furnished herewith are the minimum and maximum readings taken during a trial run over a measured nautical mile and over a measured course of 12 nautical miles, while the deduced data are the average for the above trial trip, together with a 24-hour endurance run at sea:

Full Power Trial Data

1-Mile and 12-Mile Runs

Mean speed	12.48 knots
Mean indicated horsepower, main engines	1,742
Mean indicated horsepower, auxiliaries	100
Mean revolutions per minute, main engines	83

	Maximum	Minimum
Steam pressure, boilers, pounds	195	185
Steam pressure, high-pressure receiver	145	143
Steam pressure, intermediate-pressure receiver	74	70
Steam pressure, low-pressure receiver	18	18
Quality of steam, calorimeter, percent	98	97.9
Stack temperature, degrees Fahrenheit	600	500
Flue gas analysis, percent—		
CO_2	11.1	9.9
O	9.6	8.4
CO	0.0	0.0
Pounds water per hour, including auxiliaries		27,500
Pounds coal per hour, including auxiliaries		3,090
Pounds water per pound of coal		8.9
Feed temperature, degrees Fahrenheit		200
British thermal units per pound of fuel as fired		12,451
Evaporation from and at 212 degrees Fahrenheit, pounds		9.41
Efficiency of boiler, based on fuel as fired, percent		72.2

Eight of these ships have been outfitted, trials run and made ready for service up to this time, and at the present time there are three more under process of outfitting and will be ready for service in a short time.

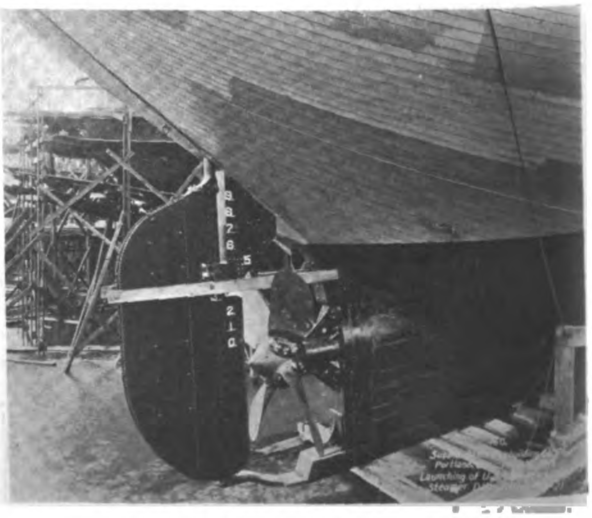

Fig. 11.—Stern of Composite Ship

Training of Enlisted Personnel of the United States Navy for Engineering Duties

BY LIEUTENANT COMMANDER R. R. SMITH, U. S. N.

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At the outbreak of the war the Bureau of Navigation of the Navy Department was confronted with the problem of supplying trained engineer personnel to man not only the vessels of the Navy in reserve, which were then being rushed into active commission, but the interned German and Austrian ships which were completing the repairs necessitated by the sabotage they suffered during their internment. New construction in excess of anything heretofore attempted was being planned, while construction under way was being rushed to completion. Deck personnel was required also, but, as Navy training has always chiefly concerned itself with the training of its deck personnel, facilities and methods were already available for this training and only required expansion. The training of the engineering personnel has, however, always been a slower process on account of the greater degree of skill required in the handling of mechanisms. Our merchant marine was small and the comparatively few merchant engineers could not be spared to the Navy. Naval recruits by the thousands could be sent to these ships, but the sending of green men to do the work of trained engineers and firemen was rejected as impracticable.

A conference was called at the Bureau of Navigation, which was attended by representatives of the commander-in-chief of the Atlantic fleet. The representatives from the fleet proposed a scheme which meant a new departure for the Navy. It required setting aside a great many old ideas, but it sounded good. The conference adjourned until the next day, when the details which had been worked out over night were presented. They were accepted, and at the suggestion of the chief of bureau it was decided that an officer should be ordered to the staff of the commander-in-chief to follow up the development of the scheme proposed.

THE PROPOSED SCHEME

The salient features of the proposed scheme as outlined in the commander-in-chief's letter were as follows:

(1) Eight battleships of the older type to be assigned to the paramount duty of training engineers.

(2) Reduction of deck complement to one-half to make room for the increased number of engineers.

(3) Greatly increasing the engineer petty officers to provide suitable instructors.

(4) Removal of practically all firemen from ships assigned to this duty.

(5) Increasing the number of trained engineer officers for each engineering ship.

The only two ships available at the time were the *Alabama* and the *Kearsarge*. Later six more ships joined the training squadron. These ships were ordered to revise their complements immediately and to transfer all engineer personnel except ninety men. Additional petty officers to make up the ninety in the required ratings were transferred from battleships not engaged in this work. All battleships were to regard one-third of their engineer complement as available for transfer, being obliged to train recruits to this number for their own vacancies.

A senior assistant to the engineer officer and two commissioned officers of engineering experience for training officers were ordered to each training ship. The complement of petty officers was as follows:

Chief machinist mates	9
Chief water tenders	9
Machinist mates, first class	9
Water tenders	27
Oilers	18
Firemen, first class	18
Total	90

The firemen were for the ship's use on evaporators, ice machines, steamers and other auxiliaries where some permanence was essential. Each ship was required to train the following men at one time:

Engine drivers	16
Oilers	32
Water tenders	32
Firemen	200
Total	280

There was thus a total of 370 engineers on board, not including the electrical force, which brought the total to nearly 400. The regular engineer complement of the *Alabama* for war conditions was 170, and during peace much less than this. In order to facilitate the work of receiving, stationing and transferring so large a number of men, it was decided that half be transferred at a time. Six weeks was decided upon as the training period. In order to alternate the transfer and commence the system, half of the men had to be transferred at the end of the first three weeks. The better half were selected, this being possible owing to the fact that the first men received came from the other ships, had been on board anywhere from one to three months and had got some training before being received on board.

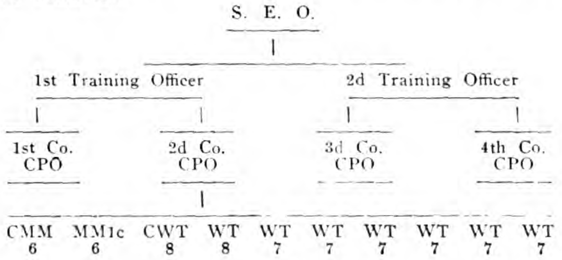
Upon the internal organization of the ship depended the success of the entire scheme. It was realized that the moment the individual man under training did not receive close personal supervision by some one person, the entire scheme would fall down. The entire organization was based on this idea and the squad system was inaugurated.

It has been stated that no one person can intelligently supervise the entire work of more than eight men; when the number is increased beyond this the closeness of the supervision is relaxed.

SQUAD SYSTEM INAUGURATED

The men under training were divided into four companies. Each officer had two companies, each company was commanded by a chief petty officer. The company consisted of seventy men under training, divided into ten squads, each squad being commanded by a petty officer not below the rating of first class. Two of these squads were engine room squads, of six men each, with a machinist mate in charge of each. One squad was in training for water tenders and was in charge of a chief water tender; seven squads were in training for firemen and each squad was in charge of a water tender.

Diagrammatically expressed, the organization was made up as follows.



Each engine room squad of six men was made up of two men in training for engine drivers and four men in training for oilers. The ship's oilers were utilized as instructors on watch, but not as squad leaders. In conducting the training the squad system was adhered to throughout.

DEPOT DIVISIONS ESTABLISHED

When the scheme was first put into operation each ship was assigned a Depot Division. Each battleship division in squadrons three and four were assigned two training ships for the purpose of transfer and receipt of men. The trained men were sent back to the Depot Division ships, which in turn transferred them where needed. A steady inflow of recruits was supplied to the Depot Ships, to supply the needs of the training ships.

Recruits without previous experience were sent for training as firemen, firemen of naval experience were sent to be trained as water tenders, while recruits having mechanical experience in civil life were sent for training as oilers and engine drivers. The latter term was devised to supply men who could operate machinery. It was thought that men could be made available for the specific duty of handling an engine much more quickly, if their training was confined to this particular subject. It was realized that any attempt to train men for general duties in the engine room would require a great deal more time than was available. The need for men was urgent and pressing.

RECRUITS OF MARKED INTELLIGENCE

Much of the success of the training was directly attributed to the fact that the recruits were men of an unusually high order of intelligence, nearly all of them having enlisted for voluntary service upon the outbreak of war. Many excellent mechanics were enlisted under the rating of machinist mate, second class, and, while they had no marine experience, they made excellent progress. Among the firemen were found many men who could have been enlisted as machinist's mates. Most of them, however, had rushed into the service in any rating. No difficulty was experienced in obtaining men for the engine room branches, but it was soon found that the supply of firemen of experience for training as water tenders was running low. A water tender can learn his regular duties without much difficulty, but experience in fireroom mishaps is essential as an element of safety. In training new men for this rating it was decided that they would not be rated, but a notation made in their records that they had been trained for this work.

The men showed the greatest enthusiasm for their work. They realized that everything possible was being done to instruct them in their future duties; that they would soon be cast upon their own responsibilities and would be expected to produce results. Men who received a certain mark were recommended for one higher rating; in some cases men of unusual ability were jumped from third class firemen to oiler, machinist mate second class or firemen first class. After a new draft had been on board one week and some knowledge of the personal qualifications of the individuals had been obtained, it was necessary to shift a few men about so as to give them an opportunity to qualify for the more expert ratings, while some men in training for the higher rating were shifted to the firemen squads.

REPAIR WORK DURING NIGHT WATCHES

During the first months of training the ships got under way at dawn and steamed until sunset, banking fires over night. On the *Alabama* all repair work was undertaken during the night watches. Feed pumps were opened, condenser tubes repacked, bearings adjusted, and everything closed up before four A. M., when steam was turned on the main steam line for warming up. We welcomed the opportunity to repair something and required the men under training to do all the work under the supervision of the petty officers. It is surprising how quickly a man can learn to do something if he is allowed to do it. While under way all the firing was done by the men under training under the supervision of the squad leader. The water was tended by the men under instruction for that rating, under the supervision of the squad leader, a chief water tender. The engines were handled and oiled by new men. It was difficult to persuade the old men that they must allow the recruits to do everything, but they finally got the idea, and later rather enjoyed it.

On a Monday morning after the receipt of a new draft the ship would be got under way by an entire crew of green men. Sometimes, upon getting under way, a signal of one-third speed ahead, followed by another of two-thirds ahead, and another of standard speed would be received from the bridge before the student could get the engine turned over. But no one was allowed to interfere, and unless the situation on the bridge was known to be urgent they were allowed to wait and suffer the delay. It must be said that the commanding officers made the best of the situation, and, while regretting the subordination of the military mission of their ships, lent their heartiest co-operation to the engineer officers.

As the interned ships were completing their repairs, the Depot Ships were discontinued and the men sent directly to the receiving ships. Each draft was detailed specifically for the ship to which it was going and the interest ran high. It was necessary in self-defense to obtain and post all data available on the ships in question to satisfy the curiosity of the men. By so doing it lent interest to the training. When the *Vaterland*, now the *Leviathan*, was commissioned, each man wanted to be sent to her. When there was no objection, each of the top men in their squads were allowed to ask for the ship they wanted, and their request was granted, if possible. The men in the deck force commenced going to the mast, requesting to be put in the training draft. Some of these requests were granted.

MEN SENT TO CAMPS AT NAVY YARDS

After the commissioning of the interned ships, the men who completed the training course were sent to the camps at the various navy yards. The new drafts were received directly from the receiving ships and this method was steadily followed.

As stated above, the training ships operated during the day only during the first months of training. Later, however, all ships operated with the fleet, and the training afforded the men below, while not so good for the engine drivers, was better for the firemen, oilers and water tenders, inasmuch as the ship was operating under conditions more closely approximating the conditions the men were to meet. It gave the firemen experience in cleaning fires, which was not necessary when fires were banked each night. At the same time the upkeep diminished rather than increased, as might have been expected from the nature of the work upon which the ship was engaged.

The watch standing was supplemented by instruction periods, twice a day for the men not on watch. The schedule was so arranged with regard to the watches that all men in training for the same rate received the same instruction.

The following courses of instruction were given. These were supplemented by lectures on naval usages and customs of the service:

Course of Instruction

ENGINE DRIVERS AND OILERS

Feed Water Supply

(1) Height of water—methods of ascertaining.
(2) Supply of feed water—how obtained.
(3) Action necessary at failure of feed water.

Main Engines

(1) Throttle valve, butterfly valve, by-passes, bleeders.
(2) Reversing engines, link gear and cut-offs.
(3) Cylinder drains and relief valves.
(4) Gage board.
(5) Bearing, main, thrust, and steady. Sterntube.
(6) Piston rods, valve stems, crossheads, gibs and guides.
(7) Engine and fire room telegraphs and counters.
(8) Vacuum and loss of same.
(9) Oil—grades used for different purposes.
(10) Oil service and water service.

Main Engines and Auxiliaries

(1) Feed pumps, main and auxiliary.
(2) Air pumps, circulating pumps and condensers.
(3) Feed heaters, separators and traps.

Feed and Steam Lines

(1) Feed tanks, reserve tanks, pumps, connections, feed lines, main and auxiliary.

Ship's Drainage, Fire Main and Flushing System

WATER TENDERS AND FIREMEN

Boilers and Fire Rooms

(1) Coal tally and passing coal.
(2) Priming, lighting off, steaming level.
(3) Firing.
(4) Cleaning fires and ejecting ashes.
(5) Care of bilges and strainers.
(6) Feed water—height of, supply, how obtained, action necessary for failure of water.
(7) Bunker gases—safety precautions.
(8) Time firing device.

Feed Lines

(1) Feed pumps, main and auxiliary.
(2) Feed heaters, separators and traps.
(3) Feed tanks, reserve tanks, pumps and connections.

Ship's Drainage and Flushing System—All Boiler Connections and Fittings

(1) Safety valves, feed checks and stops, bulkhead stops.
(2) Steam traps and cut-outs.
(3) Water columns and try cocks.
(4) Drums, handholes, manholes, door casings.

Each subject was developed by a questionnaire for the use of the squad leaders, and there is in use on board at the present time three pamphlets, one for each course. An example of one of these lessons is given below:

Course for Engine Drivers and Oilers

Lesson No. 12

	Subject	*Reference*
1.	Feed Water System	Ship's Installation. Eng. Handy Book, pp. 85, 155, 158 and 161.

Questions may be made up for this lesson from references given.

Q.—Describe the following parts of the feed water system, including the material of which they are made.
How do they operate?
How are they connected to other parts?
How are they cleaned?
What care and preservation is required?
What troubles are encountered?

1. Reserve feed tanks
2. Feed tanks.
3. Feed tank filters.
4. Feed pumps.
5. Feed heaters.
6. Grease extractors.
7. Feed lines, main and auxiliary; expansion bends.

Q.—What is back pressure? Where is it used? How much is carried? How is it regulated? What is a hot well? Where is it? Why? What is in it? Why? How often are filters cleaned? Trace the main feed line from the feed tank to the boilers, naming all the valves, pumps, expansion bends, connections and cross-connections and other auxiliaries in the line. Why are there two feed systems? Tell where they are and what cross-connections are between these two lines. When would you cross-connect them? How would you put feed water into the reserve tanks? How would you get it out?

The course was developed on the *Alabama* into the series of lessons of which the above is an example. They were made as simple as possible in order that all might understand them. The course as published is in use on all the training ships. Each ship has developed the subjects, while several have adopted the *Alabama* pamphlets.

At the conclusion of the course a page was inserted in the enlisted record of each man, giving the following information:

Intensive Training—Engineers

(C-in-C Letter No. 1885 of 4-24-17)

Trained on board U. S. S. ....
Name ....
Actual rate ....
On transfer from U. S. S. ....

Instructed as ....
General proficiency ....
Qualified as ....
Type of boiler ....
Type of engine ....
Lubrication of engines ....
Fuel ....
Received from U. S. S. ....
Date received ....
Transferred to ....
Date transferred ....

The training has been in operation for about fifteen months at the time of writing this article. Approximately 16,000 men were trained in this time. These men are now doing duty on all types of ships, including battleships, cruisers, transports, destroyers, yachts and submarines. On a recent trip abroad the writer had an opportunity of questioning a great many of the men who had passed through the training course. Many of them had been

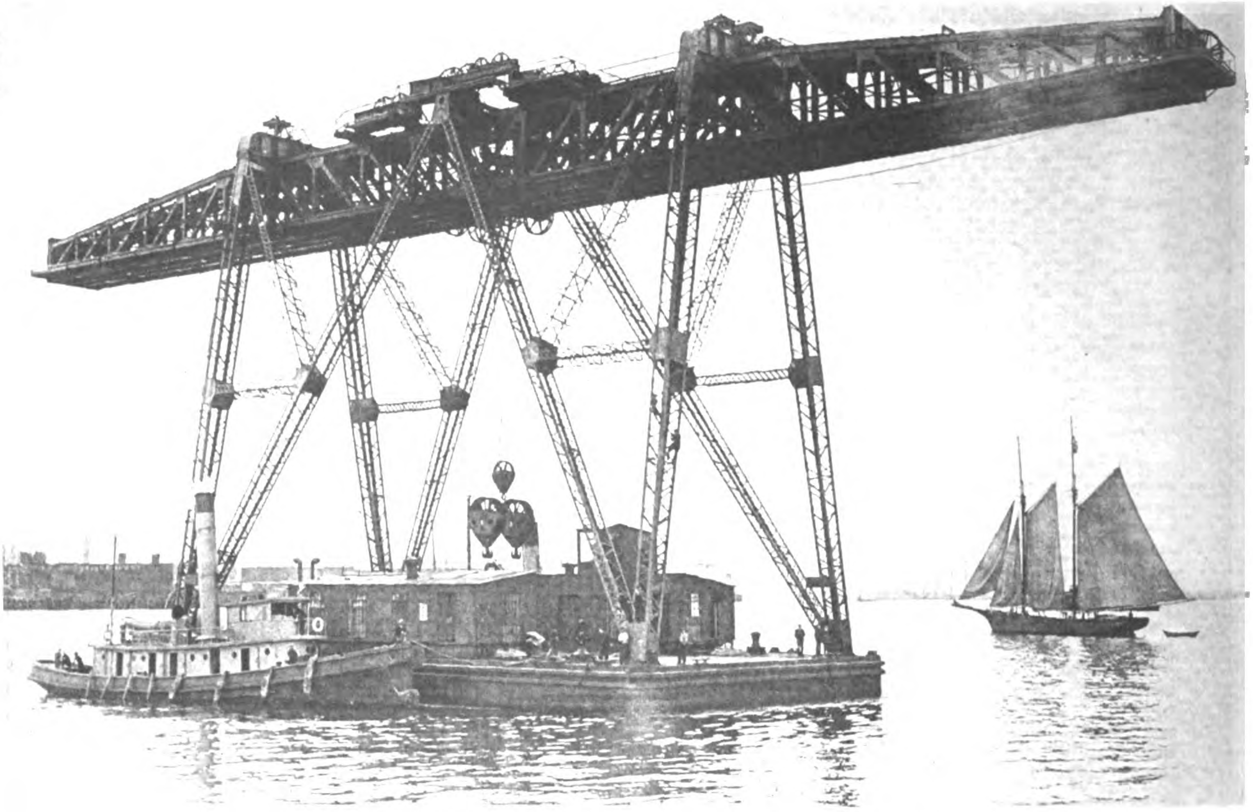


Fig. 1.—150-Ton Pontoon Bridge Crane in Operation at Boston

advanced in rating. This is the best indication that their training had been satisfactory. The reports received from the officers who were working with these men were very satisfactory.

What was a great problem at the beginning of the war has been solved in a very simple manner. If it had not been satisfactorily solved, it is believed that the Navy would have been seriously hampered in its operations. The absence of fireroom and engine room casualties must indicate that these men who have come into the Navy since the commencement of the war have been making good. The officers who have had a part in this work can feel that they have contributed directly and effectively towards the excellent showing of the Navy during the past year.

150-Ton Electrically Operated Pontoon Crane in Operation at the Boston Navy Yard

European ports have long recognized the utility of the floating crane, and it has been used extensively in all the larger harbors of Great Britain and the Continent. But in America the merchant marine developments have hitherto been so small in proportion to our general industrial growth that the use of the pontoon crane in this country has been limited largely to the needs of the Government in connection with naval work. The variety of uses to which this type of crane can be put, however, should cause it to appeal strongly to all harbor authorities on this side of the Atlantic.

Besides being used for lifting, handling and moving of heavy guns, turrets, armor plates, etc., to and from battleships without the necessity of running into dry dock, the pontoon crane can be and has been used with decided advantage for raising small sunken craft, such as tugs; for launching moderate-sized boats; for lifting them out of the water, for scraping; for fitting out ships; for placing boilers in launched hulls; for extraordinary lighterage

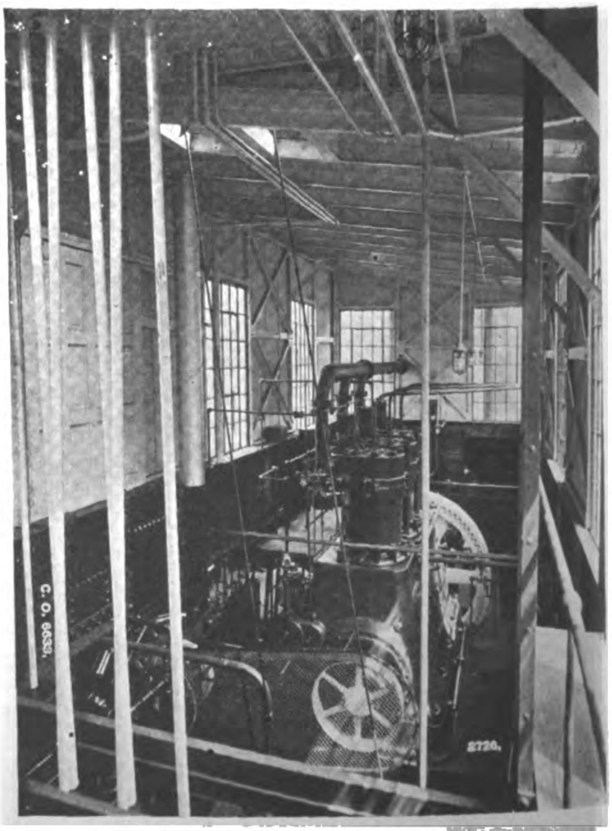


Fig. 2.—Electric Generator Driven by Diesel Engine on Pontoon Crane

problems, and, in fact, for any service where heavy lifting is required on or around docks or anchored vessels. These cranes will also be found invaluable for handling equipment for the large vessels to be constructed in this country during the next few years.

The majority of American-built floating cranes are of the bridge type. These machines admirably fulfill the purposes for which they are designed and have the advantage of being considerably less expensive than the revolving type. Fig. 1 shows a 150-ton electrically operated bridge type pontoon crane in Boston Harbor. This crane was built by the Wellman-Seaver-Morgan Company, Cleveland, Ohio, for the Boston Navy Yard.

The two main hoists of this crane have a capacity of 75 tons each, and the auxiliary hoist a capacity of 15 tons. The main hoists run on separate runways and can be used simultaneously or separately. The vertical speed of each is 7 feet per minute loaded, and 200 feet per minute unloaded. The horizontal speed is 100 feet per minute.

The pontoon, or float, on which the crane is installed is 120 feet long, 70 feet wide and 14 feet deep. Eight counterbalance tanks are provided, four at each end of the pontoon.

Power for operating the crane is supplied by generator sets driven by Diesel oil engines, one of which is shown in Fig. 2. Besides this the crane has a large equipment of Edison storage batteries, which make possible emergency operation at any time without outside power. Through cable connections, electric power can also be secured from the shore.

Marine Turbine Governors

BY P. M. ROBINSON*

It is hard to conceive of a more constant power load than that obtained on the propelling unit of a ship at sea in fair weather. The weight and resistance of the ship cannot be changed, nor can the dimensions of the propeller be altered. So hour after hour and day after day the load to be carried by the engines remains uniform.

A governing device to prevent the machinery from overspeeding is practically unnecessary except to guard against the possibility of breaking a shaft or dropping off a propeller, either of which occurrence is rare.

However, in bad weather we encounter an entirely different situation. With the ship rolling and pitching the propeller is often thrown partially or wholly out of the water, thus relieving the entire load from the engines and allowing them to accelerate rapidly and perhaps reach dangerous speeds.

In the case of a reciprocating engine with all its moving parts, the first symptoms of racing are immediately apparent, and it is the usual practice to station an engineer at the throttle to keep the speed within safe limits.

In the case of a turbine the first indications of racing are not so apparent to the watch engineer, because there are practically no moving parts in sight. The only evidence of an increase in speed is a change in the sound and vibration of the unit, from which it may be difficult to judge what the safe limit really is. Nevertheless, the danger of wrecking a turbine through overspeeding is just as great as the danger of wrecking the reciprocating engine under similar conditions.

To guard against this hazard the majority of marine turbine builders install on their machines an automatic tripping device, which is set to shut off all steam to the turbine when the speed reaches a limiting point of 10 percent or 15 percent above normal. This stops the turbine entirely, and in order to start up again the trip must be reset and the steam valve opened.

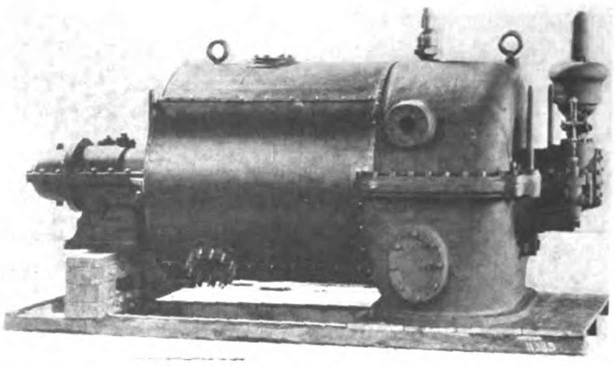


Fig. 1.—Complete Turbine, Showing Governor and Relay Valve at Right-Hand End

Undoubtedly such a device thoroughly protects the turbine from damaging itself by racing, but there are certain contingent disadvantages which make it very undesirable. Chief among these is the possibility of having the turbine shut down even for a short time during a storm, when the loss of steerageway may throw the ship into the trough of the sea with the very possible result of foundering. For this reason a great many chief engineers prefer to disconnect the tripping device entirely, and leave the turbine with no protection at all rather than take the chance of jeopardizing the safety of the whole ship.

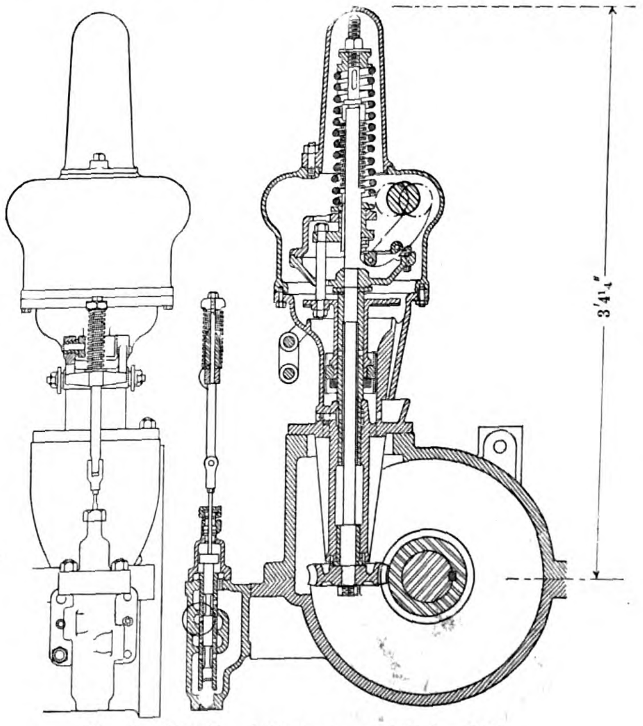


Fig. 2.—Details of Governor and Relay Valve

All Westinghouse marine turbines are fitted with governors, which under no circumstances will shut the turbines down completely, but which will regulate the flow of steam to the nozzles in such a manner that the speed is kept practically constant under all conditions.

The arrangement consists of a vertical spindle mounted on the forward end of the turbine, driven by a worm wheel from the main shaft at a speed of about one-quarter of that of the main shaft. At the top of this spindle is mounted a fly ball governor of the familiar type, the motion of which is transmitted through a system of levers to a small steam relay piston valve, which in turn regulates the flow of steam to the operating cylinder of the main governor valve.

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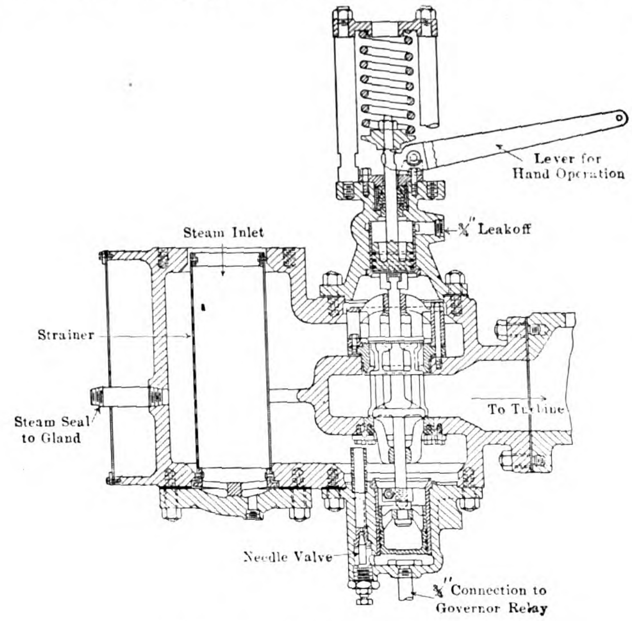

Fig. 3.—The Governor Valve

As the speed of the turbine increases above normal, the governor weights are thrown farther away from their center of rotation by centrifugal force and the steam relay valve is moved a corresponding amount. This opens up the steam ports, which exhaust the steam from the bottom of the governor valve operating cylinder, producing an unbalanced condition, and the governor valve starts to close, slowing down the turbine. But as soon as the speed is reduced to normal the governor weights return to their former position, moving back the relay and reopening the governor valve.

While no attempt is made to obtain extremely close regulation, such as is needed on electric generator drives, it has been found that the marine governors are very positive in their action and hold the speed of the turbine within very reasonable limits.

The chief engineer of a Westinghouse installation recently reported that in bad weather, with the vessel loaded, the turbines did not vary more than 2 percent above or below the normal revolutions per minute, and with the vessel running light the maximum variation recorded was only 4 percent above or below.

New Floating Dry Dock for Savannah

THE first pontoon of the new 8,000-ton sectional floating dry dock for the Savannah Dry Dock & Repair Company, Port Wentworth, Savannah, Ga., was successfully launched at the company's yard on April 15, 1919. Since then three other pontoons, of the total of six, have slid into the water.

The pontoons are of wooden construction, but are designed and constructed so that when the pontoons are joined together they form a single, rigid unit. This rigidity is due to longitudinal, pin-connected trusses, a patented feature of the designers, which form an integral part of each wing and which overcome the objection to the ordinary wooden sectional floating dock—its excessive flexibility.

The photographs show the simplicity and accessibility of the pin connections which join the pontoons and the truss members. Each pontoon is 63 feet in length, which, with the fantails of the end pontoons, form a dock capable of handling vessels up to 480 feet long and 8,000 tons displacement.

The pumping machinery consists of twenty-four electrically operated pumps, four in each pontoon, the control of which is so arranged that all will be operated from a central house on shore. On the end of the dock op-

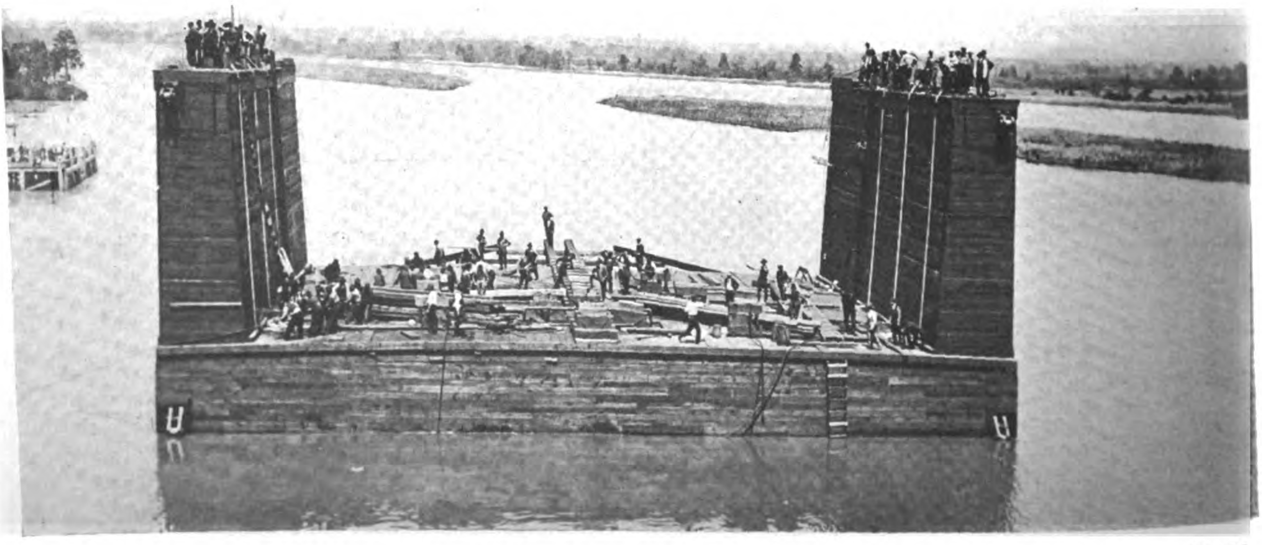

Fig. 1.—Second Pontoon Launched at Savannah Dry Dock & Repair Company, Port Wentworth, Savannah, Ga., April 19, 1919. Fantail Section of 8,000-Ton Crandall Dock

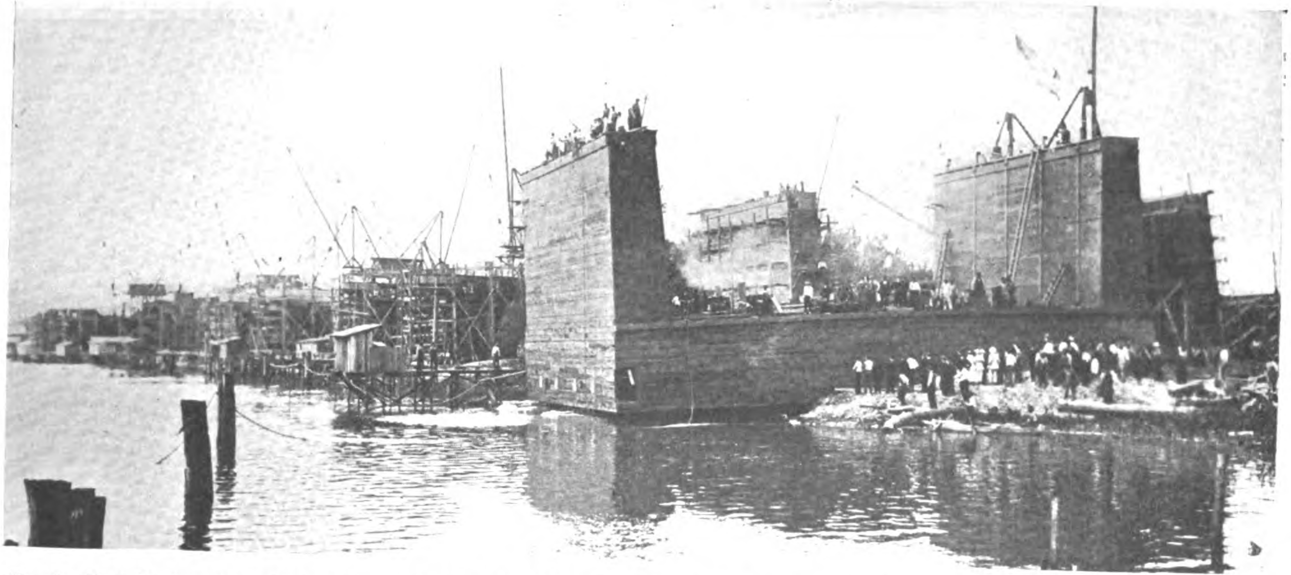

Fig. 2.—First Pontoon Launched at Savannah Dry Dock & Repair Company, Port Wentworth, Savannah, Ga., April 15, 1919. Intermediate Section of 8,000-Ton Crandall Dock. Two Ways, Each 2 Feet Wide, ⅝-Inch Declivity. Distance from Outboard Perpendicular to End of Ways 98 Feet. Grease Used, Stearine, Tallow and Graphite. Perfect Launching

posite the control house will be a water register for showing the height of water in each compartment of the dock, thus enabling the dockmaster properly to regulate the pumping of the dock compartments to suit the ship.

Releasing bilge blocks operated by winches on the wing walls of the dock are employed throughout.

The dock was designed by The Crandall Engineering Company, dry dock engineers, East Boston, Mass.

The Heine Marine Cross Drum Boiler

Marine boilers of two types have been built by the Heine Safety Boiler Company in their plants at St. Louis, Mo., and Phoenixville, Pa.—the "longitudinal drum" type and the "cross drum" type. The former is built on the lines of the well-known Heine watertube boiler and the earlier ships were fitted with these, but the later and by far the greater number of ships have received boilers of the "cross drum" type, which has shown itself so superior for the peculiar and exacting marine service that it is now the standard Heine marine watertube boiler.

The boiler proper consists essentially of three pressure elements joined together by a multiciplicity of tubes. These elements are two flat rectangular box headers and a cylindrical steam drum as shown in Fig. 1. The main bank of tubes extends between and connects the two box headers, which are set with the flat surfaces a certain distance apart. The connecting tubes are all of the same length, straight and parallel with each other, and when this part of the boiler is set in operating position are inclined at an angle of sixteen degrees to the horizontal. Above the front box header and slightly to the rear of it is placed the steam drum, which is connected to the front header by a row of nearly vertical short tubes or nipples and to the rear header by a row of longer tubes, which are horizontal when the boiler is set. The boiler proper, made up of drum, box headers and tubes, is supported by a strong, rigid,

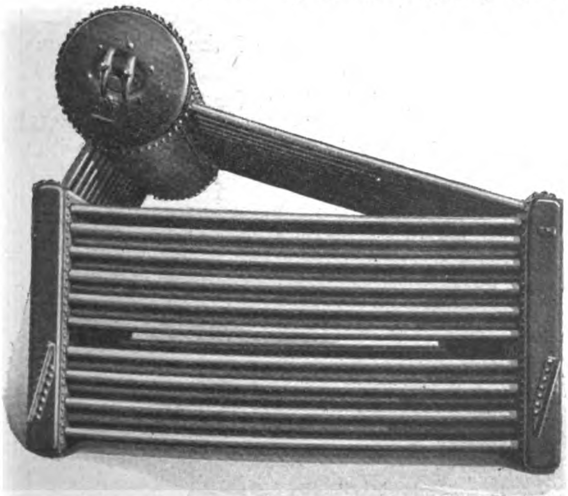

Fig. 1.—Headers, Tubes and Drum

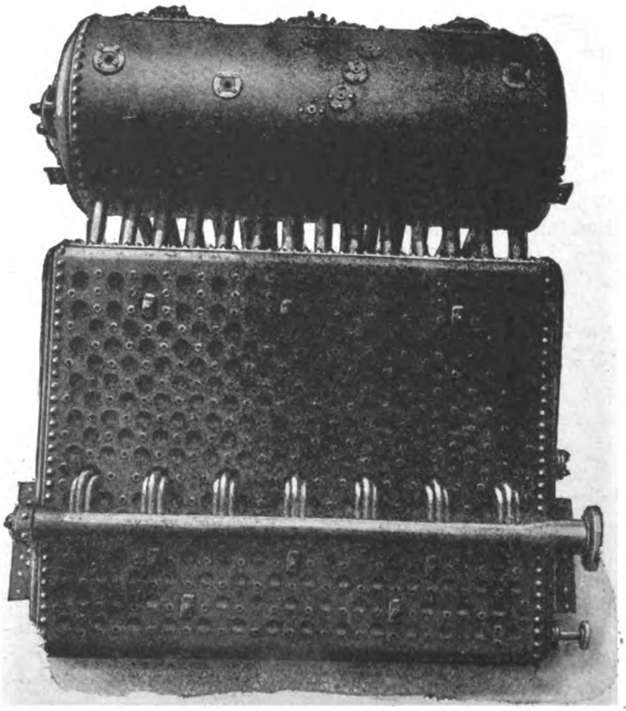

Fig. 2.—End View of Boiler, Showing Superheater Elements

steel structure resting on and secured to proper foundations in the vessel—partly shown in Fig. 3.

STEAM DRUMS

The steam drum is cylindrical and varies in the several sizes of boilers from 36-inch to 48-inch in diameter. It consists of a single plate steel shell of a thickness corresponding to the pressure requirements, rolled to a true circle, fitted with a double-riveted, double butt-strapped longitudinal riveted seam, and at the ends with flanged and dished steel heads which require no braces. In one of these heads is arranged a flanged-in manhole for access to the interior of the steam drum. Where the tubes enter and are secured to the shell of the drum, reinforcing plates are fitted. On top of the drum are fitted heavy pressed steel saddles for attaching the main stop valve, auxiliary stop valve and safety valve.

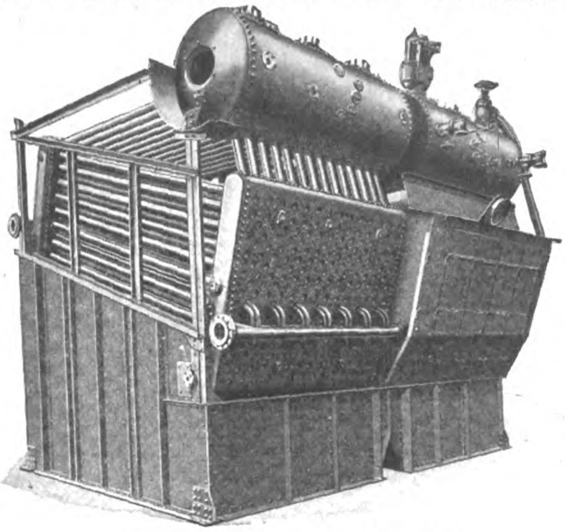
Fig. 3.—Boilers Partly Assembled

To the front side of the drum shell are riveted pressed steel flanges for attaching the main and auxiliary feed check valves, surface blow valve, two water gage glasses and three test cocks.

DRUM FITTINGS

Inside the drum, properly secured to the shell and firmly braced in position, is fitted a steel deflection plate. This plate is of sufficient length to cover the ends of the horizontal tubes and extends below the water level, its purpose being to act as a separator for the mixture of steam and water entering the drum through the horizontal tubes. Water thrown violently against this plate runs downward into the body of water below, and the steam passes along and around the ends of the plate and to the dry pipe above.

An internal feed pipe is fitted between the feed check valves. This is perforated in order to distribute the entering feed water uniformly through the water already in the drum to avoid producing undue strains. The same pipe is connected to both checks.

A scum pan of the usual "dish" type, with its cover plate slightly raised to produce an efficient "skimmer" effect, is located at the center of the drum exactly on the water line and piped to the surface blow outlet on the front of the drum shell.

Surge plates are fitted to check the rush of water along the drum as the vessel rolls in a seaway. These plates, together with the deflection plate, make a substantial structure for supporting and securing the various fittings within the drum.

The main steam outlet is provided with a dry pipe of ample area. This pipe is fitted as near the top of the drum as practicable, and has slots cut through its upper side, the area through these slots exceeding the area through the outlet opening. Calorimeter tests show that the Heine marine boiler thus fitted delivers steam containing less than three-quarters of one percent of moisture.

INSTALLATION OF ZINC SLABS

Zinc slabs are also fitted in the drum of the boiler. The Navy standard of three-quarters of a square foot of exposed zinc plate is provided for each one hundred square feet of heating surface of the boiler. These zinc plates are secured so as to give close metallic connection with the metal of the boiler and yet allow easy renewal. A pressed steel "basket" is also fitted to catch the disintegrated zinc.

The box headers are constructed entirely of steel plate. Each consists of two flanged rectangular heads or end plates to which are riveted a wrapper plate in two pieces. These headers are so designed that all seams are readily accessible for inspection and recalking without tearing away the boiler casing. The end plates are flanged by hydraulic pressure at a single heat and are of the exact shape desired. The two wrapper plates, known as the tubesheet and handhole sheet, have their edges turned over at the top and bottom of the headers, lapped and riveted together with a single row of rivets, with the calking edges facing outward. The flat surfaces of the tube and handhole sheets are truly parallel with the handhole exactly opposite each tube hole, thus permitting access to the tube for cleaning and withdrawal of the tube through the handhole when necessary.

The two flat surfaces of the box headers are stayed to resist internal pressure with large hollow steel staybolts screwed through tapped holes in the plates and with the projecting ends of staybolt riveted over on the outside.

The staybolts are threaded only at the ends, leaving a smooth cylindrical shank within the water space, thus offering no sharp edges or grooves to the corrosive effect of rust. Each staybolt has a hole throughout its entire length of ample size to pass freely a ⅜-inch pipe lance for soot blowing.

SUPPORTING LUGS

Forged steel tee bar lugs (see Fig. 1) of heavy section, about 24 inches in length, are riveted to the outside of each flanged end plate of the headers for attachment t the supporting columns of the casing structure. The flat bases of these tee bar lugs are calked all around, and the edges are always accessible for inspection or recalking without tearing out any part of the boiler support or setting.

Near the bottom of the front (lower) box header and on one side only (except in extremely wide boilers) is riveted a forged steel flange to which is bolted, with copper gasket in male and female joint, a heavily ribbed and flanged composition blow nozzle or extension pipe to the outer end of which is attached the bottom blow valve. An internal pipe leads to the extreme bottom of the box header and insures removal of sediment deposited therein.

The standard design of Heine marine watertube boiler has 3½-inch diameter tubes throughout. For oil fuel only the use of 2-inch tubes instead of 3½-inch tubes in the inclined bank between the headers is recommended, and the company builds a special oil-burning marine boiler so fitted. Two-inch tubes are not recommended for coal fuel because of the great tendency of boilers fitted with small tubes, closely pitched, to "soot up" or become choked. Its superior steaming qualities are recognized.

Machinery of the Battleship New Mexico

(*Photographs by General Electric Company, Shenectady, N. Y.*)

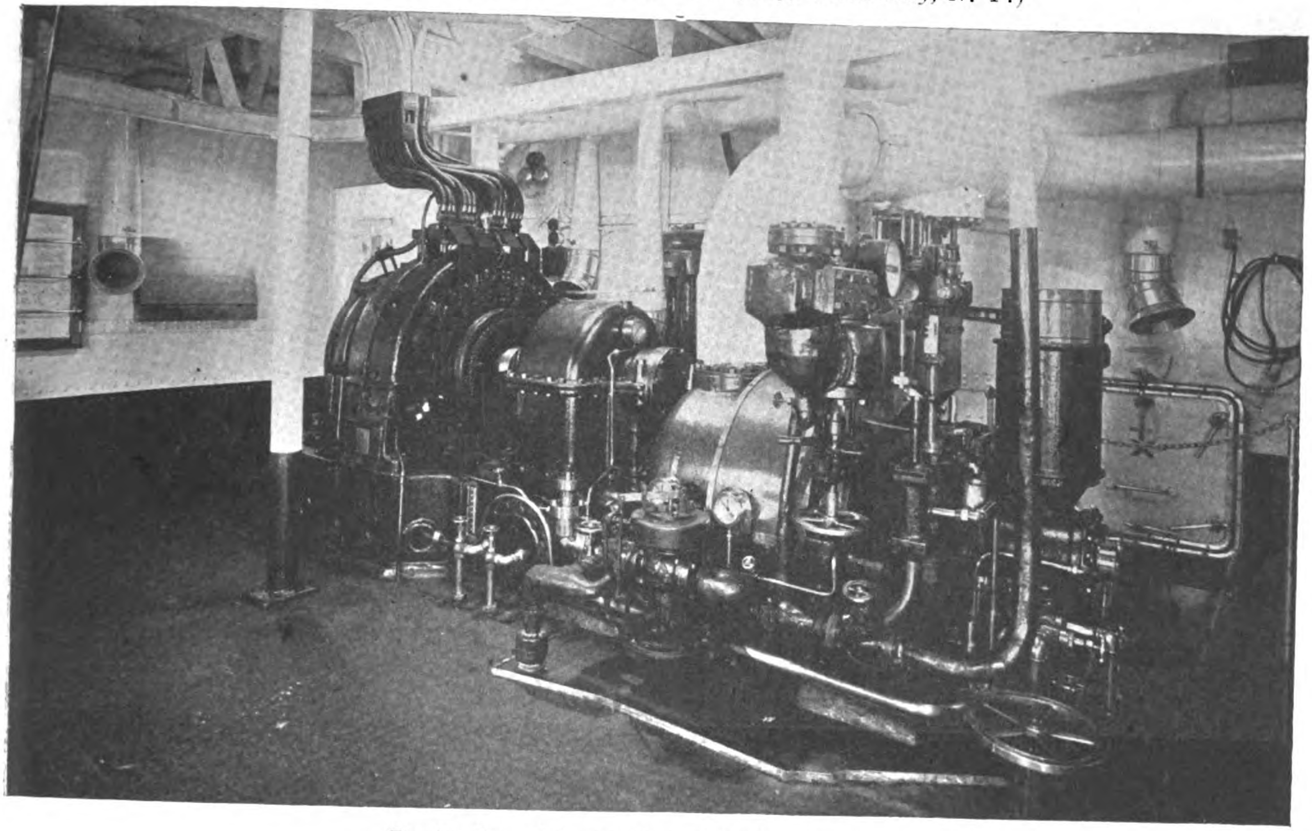

Fig. 1.—One of the Auxiliary Turbo-Generator Sets

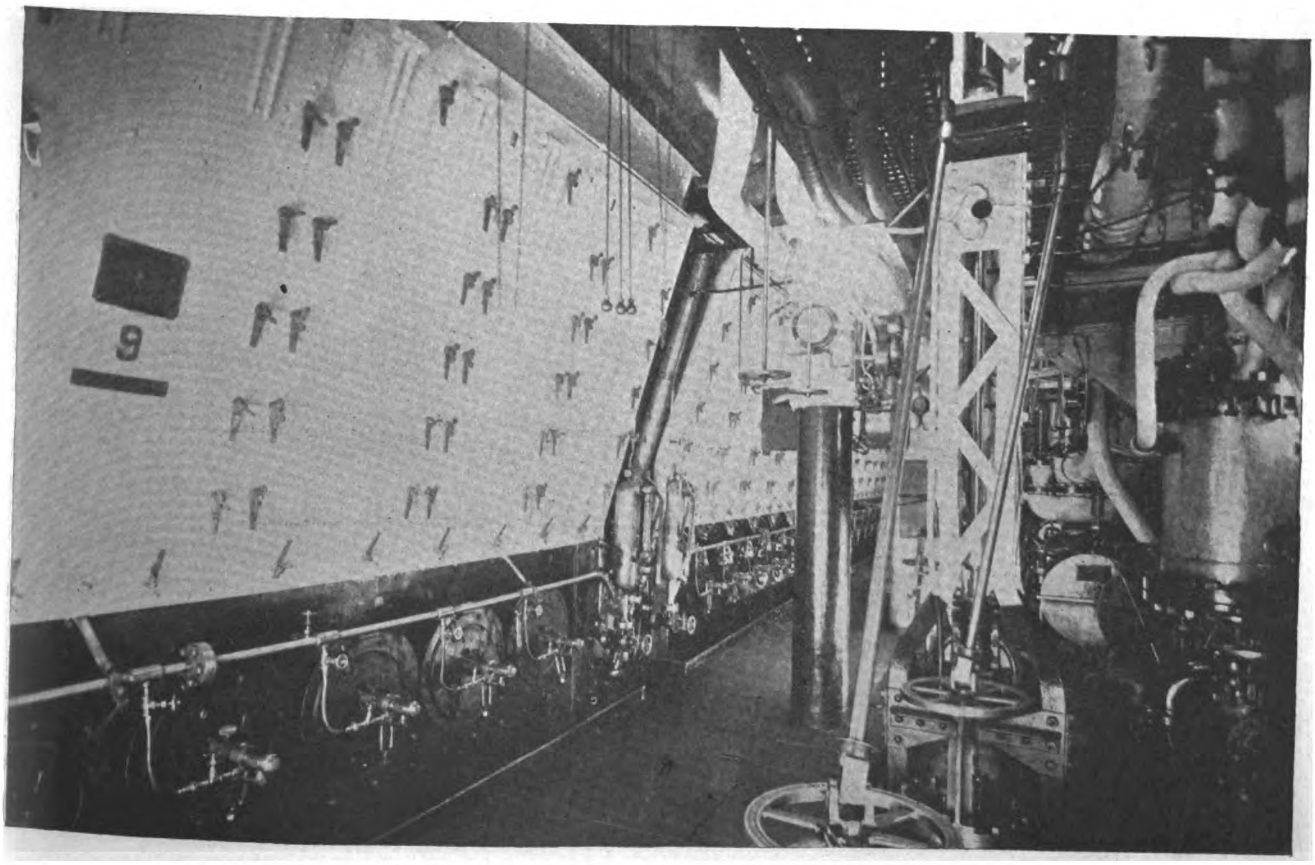

Fig. 2.—One of the Boiler Rooms on the *New Mexico*

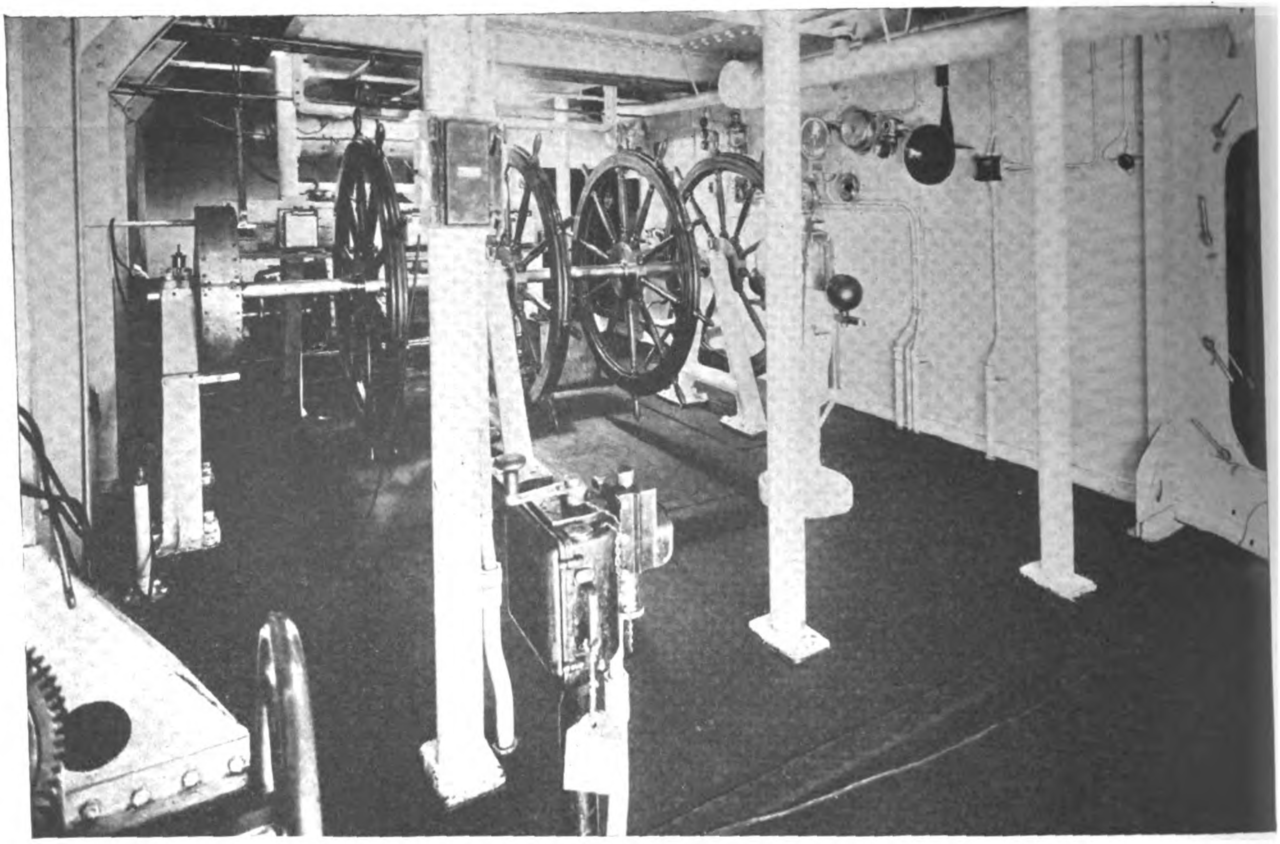

Fig. 3.—Auxiliary Steering Engine Room

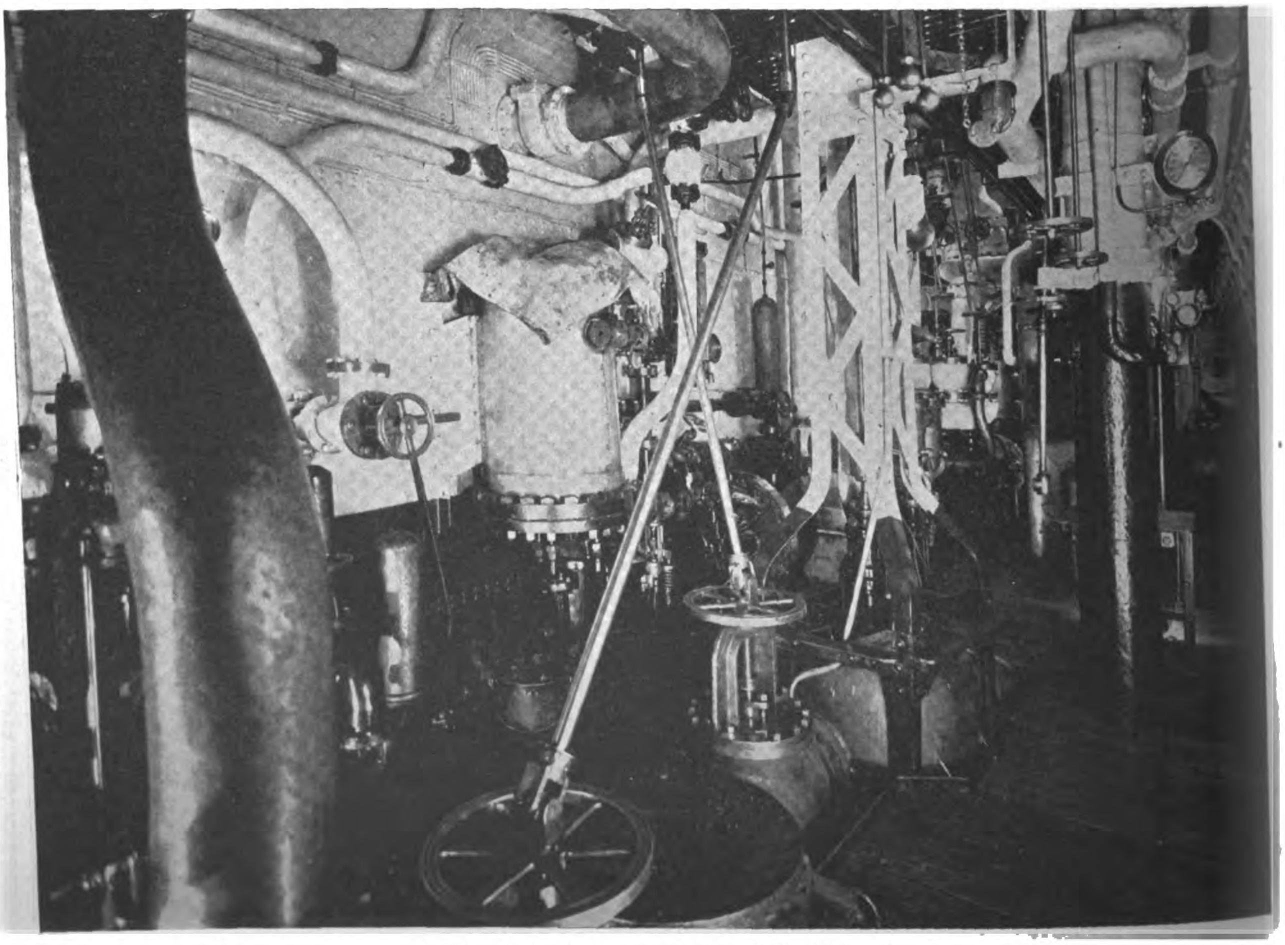

Fig. 4.—Fuel Oil Pumps in One of the Boiler Rooms

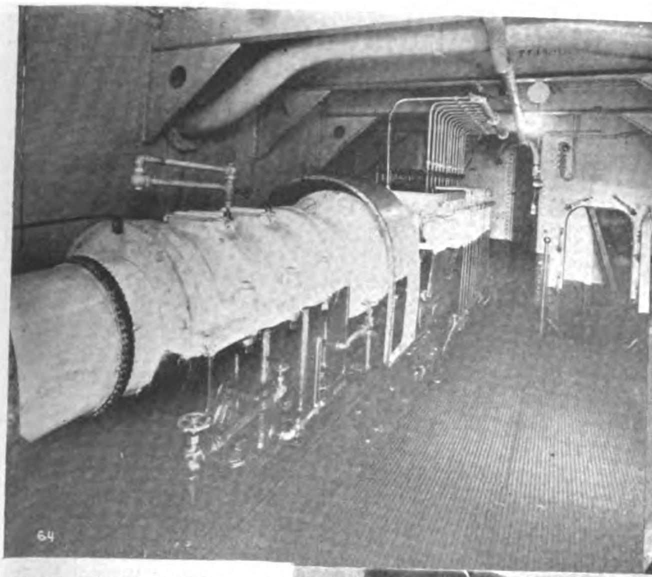

Fig. 5.—Starboard Inboard Propeller Shaft

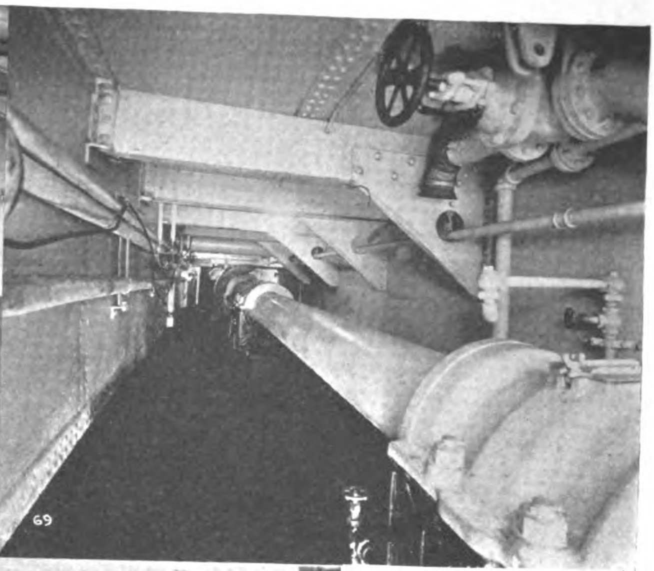

Fig. 6.—Port Inboard Propeller Shaft

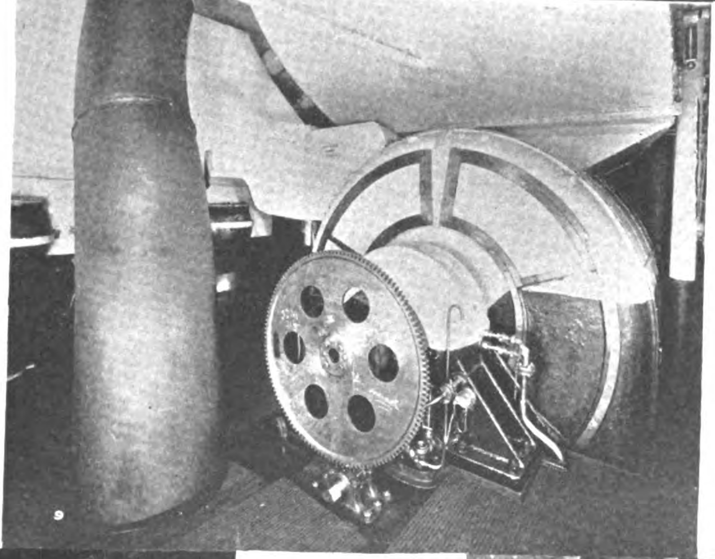

Fig. 7.—One of the Main Turbo-Generators

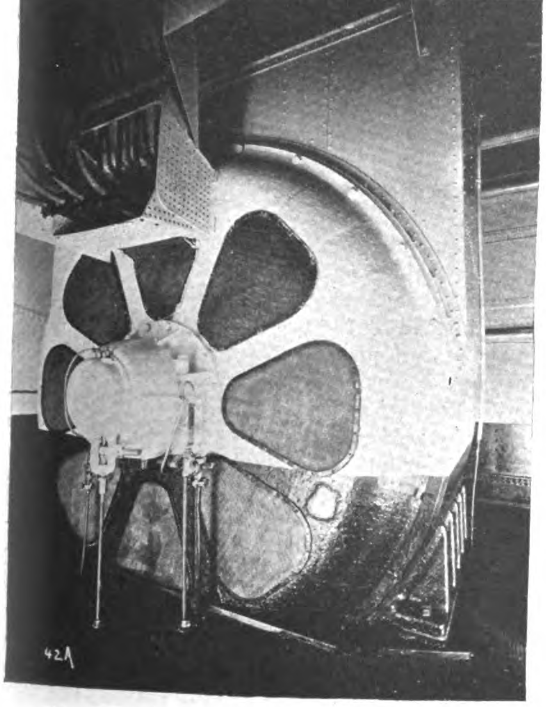

Fig. 8.—Forward End of Propelling Motor

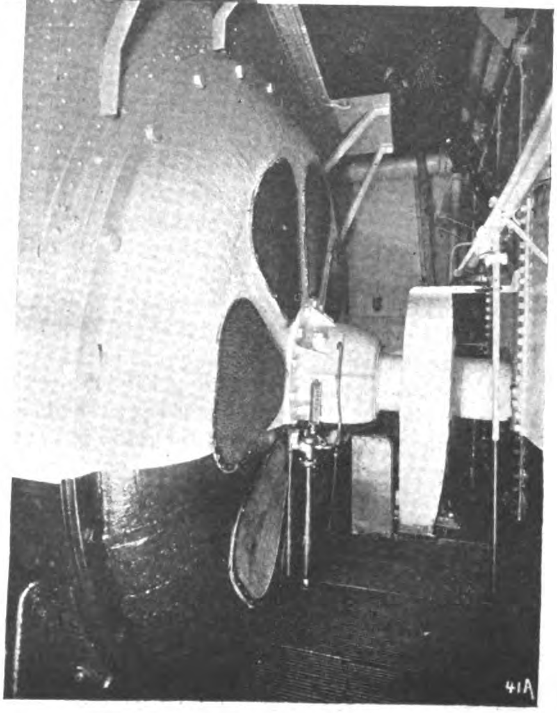

Fig. 9.—After End of Propelling Motor

Motor Trucks and the Problem of Efficient Marine Freight Terminal Operation—III

BY MERRILL C. HORINE

As emphasized in the previous installments of this article, the weak link of our transportation facilities as applied to overseas commerce is not in the railroads or ocean carriers, but in the methods and facilities employed for handling freight at the marine terminals. No one will dispute the statement made by the author in this issue that the American public and American industry want world trade and a powerful merchant marine. But how long will it be before the public wakes up to the fact that there is something wrong with our terminals and that efficient terminals are an indispensible factor if our newly born shipping industry is to survive?—THE EDITOR.

AMERICAN commerce on the high seas is more in jeopardy from inefficient methods in our own ports than it ever was from the exploits of piratical Germany.

Transportation is the foundation of civilization and the pathway of progress. Transportation is a chain, and only as efficient as the most imperfect link. That weakened link to-day lies between the steamship and the railroad or warehouse. Thousand-foot merchantmen, 12,000-horsepower locomotives, 100-ton freight cars and a surplus of low-priced quality manufactures will be our ruin rather than our gain, if this rusty, inadequate, unwieldy link is not replaced quickly with terminal transportation on a par in efficiency with the railroads and steamships it must serve.

> "There is no royal road to terminal efficiency, else it would have been traveled long ago. But there is a key to the situation, and that is motor trucks. Big tonnage on the water, big tonnage on the railroads, high speed at both places—these things spell economy because they save both time and labor. To realize their advantages to the full they must be linked up by road vehicles of big tonnage and high speed, as compared with the horse vehicles making their last stand at city terminals today."
> —MERRILL C. HORINE.

Too often generally demanded reforms are impeded by the very inertia of their size. Where a small number of people are concerned it is comparatively easy to overturn precedent; but where practically every element of business is concerned it is difficult for one party to effect concerted action. But in these days the man, or concern, or nation, which says a thing cannot be done is continually being interrupted by someone doing it.

When the great delusion about the United States being splendidly isolated by 3,500 miles of ocean, of a million men accustomed to bear arms springing to arms overnight, and of the independence from Europe of American manufacturers was shattered by the events of the past two years, America learned a few lessons. We awoke from our fatuous dreams and created a great army. We sat up and paid attention to what was going on in this world of which we are a part and took a hand in setting a few things to rights. American industries that had been dependent upon an enemy power for essentials started independent production. We made our own dyes, our own nitrates, and discovered independent sources of platinum.

The American public and American industry want world trade and a powerful merchant marine. We know that something is wrong with our terminals and that efficient terminals are indispensable to export and shipping supremacy—nay, even survival. American industry, in particular shipping and export interests, will either determine what must be done and do it quickly, or some other nation less prone to procrastination will do what we ought to do and capture our trade and our merchant marine.

The Shipping Board has announced that the largest ships afloat are to be built for American commerce and that a terminal with 1,200-foot piers is to be built either at Montauk Point, L. I., or in the lower bay of New York. The city of New York is planning other mammoth terminal enterprises. Will these undertakings be turned over to architects for the development of pleasing proportions and conventional arrangement, or will a real engineering job be made of them? Will they be arranged for the easy-going horse transportation of our grandfathers' day, or with recognition of the imperative needs of the motor transportation that must soon displace the horse at the freight terminal as it is doing or has done in practically every other field?

If the government is to undertake this new construction with the far sight that the situation of America in world trade demands, some fundamental requirements must be met.

Direct railroad connection by at least four-track lines must be possible with one of the larger general yards of the port or with a special union yard adjacent. Each pier must have at least two tracks running its length and with space for cars totalling a capacity ample for one-third of the cargo of the largest ship to use the pier. This will permit the entire carload volume of freight in an average cargo to be transferred direct between the car and the ship's hold at the speed at which the ship is able to load or unload, the train being sorted after loading or before unloading, as the case may be, in a switchyard instead of the present method of sorting or collecting the cargo piecemeal from a score or so of freight yards by means of horse vehicles or lighters.

A reception floor of sufficient area to provide 10 square feet per ton of deadweight cargo capacity of the largest ships to use the pier must be provided and there must be a duplicate of this floor on a different level for collection of outbound cargoes.

In the case of a quay, wharf space equal to one such floor is sufficient, since not more than one ship may berth on its frontage at a time, whereas one may unload on one side of a pier while another is loading on the other.

Slip space wide enough to accommodate ample coal barges to coal ship while loading and unloading at the highest rate of speed which the most improved devices for this purpose permit will be required.

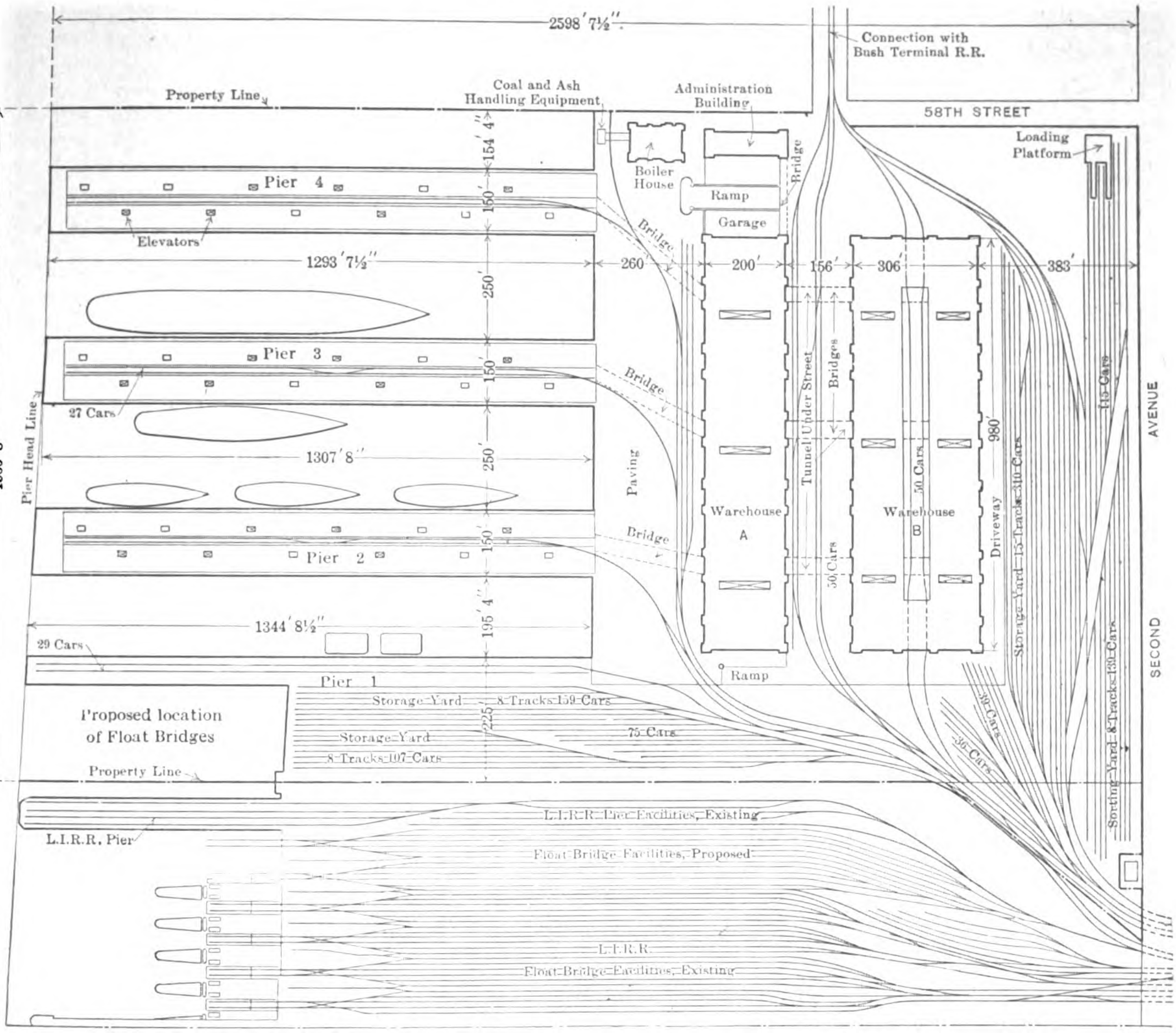
2598′ 7½″
Connection with Bush Terminal R.R.
Property Line
Coal and Ash Handling Equipment
Administration Building
58TH STREET
Loading Platform
Boiler House
Ramp
Garage
Bridge
154′ 4″
Pier 4
150′
Elevators
1293′ 7½″
260
200′
156′
306′
383′
250′
Pier 3
27 Cars
Pier Head Line
1307′ 8″
NEW YORK BAY
1566′ 8″
Paving
Tunnel Under Street
Bridges
Warehouse A
Warehouse B
50 Cars
980′
Driveway
Storage Yard 15 Tracks 310 Cars
115 Cars
AVENUE
SECOND
Pier 2
50 Cars
1344′ 8½″
195′ 4″
29 Cars
Pier 1
Storage Yard 8 Tracks 159 Cars
225′
75 Cars
Proposed location of Float Bridges
Storage Yard 8 Tracks 107 Cars
Property Line
39 Cars
36 Cars
Sorting Yard 8 Tracks 130 Cars
L.I.R.R. Pier
L.I.R.R. Pier Facilities, Existing
Float Bridge Facilities, Proposed
L.I.R.R.
Float Bridge Facilities, Existing

Fig. 17.—Four Piers and Two Warehouses Comprise the Army Base Terminal at South Brooklyn. The First of These Piers Is for Car Floats, the Remaining Three for Steamships. Each Is Approximately 150 Feet Wide by 1,300 Feet Long, Double-Decked and Connected with the Warehouses by Two-Way Bridges. Each Pier Is Double-Tracked Down Its Center and Is Equipped with Six Elevators. They Are Separated by Slips 250 Feet Wide and from the First of the Two Broadside Warehouses by a Paved Bulkhead 260 Feet Deep

Warehouses, either on upper floors of the pier or on the land directly adjacent to the piers, must be provided, each warehouse to be of sufficient floor space to accommodate at least five times the total capacity of all piers included in its frontage. Thus, if the warehouse included three piers in its frontage, each of which has floor space to receive two 1,000-foot ship loads, the warehouse would require floor space sufficient to accommodate thirty such ship loads.

These warehouses should have direct rail connections, sufficient to spot cars enough to handle the freight as fast as the assumed three piers could load it or unload it to or from the ships. Thus, if in an emergency the warehouse were full and freight were moving to it for shipment as fast as the ships were taking it away, or vice versa, and the goods longest in the warehouse had to be moved first, such correlation between the railroad and the ship would make the terminal an efficient link between the two.

The connection between the warehouse and the piers should be by tunnels, bridges or both, so that the interior transportation system could move in and out without crossing the railroad tracks or vehicle roadways. Such connections should be two-way, so that continuous streams of interior carriers could move in both directions.

Vehicular traffic should be restricted normally to the warehouse, which should be provided with space for a sufficient number of trucks to handle double two-thirds of the maximum tonnage possible to load and unload from vessels at the piers. The average vehicle haul from New York terminals is about 4½ miles round trip. However, the spreading-out process that is resulting from better transportation may, and probably will, increase this to as much as 10 miles round trip. At an 80-mile haul a 7½-ton truck is consuming about the normal working day at city traffic speed and fairly good loading efficiency. With 10-mile average round-trip hauls, and estimating 66⅔ percent load factor, or 5 tons each way per trip, each truck would be capable of moving 10 tons to and from the warehouse eight times a day, a total of 80 tons daily.

Ten feet of loading platform space per vehicle should be provided. If the railroad tracks are run along the sides of the warehouse, the vehicle platforms should be within the building, or if the tracks run into the building the vehicle platforms should be along the edges. In each case the loading platforms should be of a height to bring the car or truck floors even with the floors of the interior transportation trucks or trailers, the height of these floors being taken with the springs depressed, as under full load, since the slight lifting necessary onto an empty car or truck can better be performed to the relatively firm floor of the car or truck than the rather unstable one of the warehouse truck or trailer.

Of the two arrangements of tracks and vehicle platforms, the arrangement involving spotting the cars outside and the vehicles inside is to be preferred, since then the steam locomotives do not smoke up the interior and ramps from the interior driveways can be arranged by which the vehicles may be operated over the floors and onto the elevators of the warehouse, if desired. Where heavy machinery, etc., is involved, this is often of great convenience.

On the piers the best arrangement of tracks is down the center of the wharf, leaving wide floors on either side for the free movement of goods going on and off the ship and for the operation of the warehouse trucks and tractors. For convenient handling of freight between the ship and the railroad cars, cargo masts at the edges of the pier and traveling locomotive cranes are perhaps most effective. The same sling by which articles are raised from the hold of the ship's crane may then be used clear to the side of the car.

This arrangement need not interfere with customs in any way, as the warehouse will be an integral part of the terminal and can be bonded entire. By moving import cargo directly to a receiving and classifying floor of the warehouse, customs inspection can be carried out at leisure and without interfering with the free movement of goods. In this way a bonded terminal can offer many of the advantages of the European freeports, such as Cuxhaven.

> "Direct railroad connection by at least four-track lines must be possible with one of the larger general yards of the port or with a special union yard adjacent. Each pier must have at least two tracks running its length and with space for cars totalling a capacity ample for one-third of the cargo of the largest ship to use the pier. This will permit the entire carload volume of freight in an average cargo to be transferred direct between the car and the ship's hold at the speed at which the ship is able to load or unload, the train being sorted after loading or before unloading, as the case may be, in a switchyard instead of the present method of sorting or collecting the cargo piecemeal from a score or so of freight yards by means of horse vehicles or lighters."—Merrill C. Horine.

An additional advantage of having the vehicle platforms within the warehouse is that the driveways may then be used as a garage for the trucks, with repair shops in direct connection. Thus no time need be lost in running to and from the garage and the nightly or early morning greasing, oiling and inspection may be made while the bodies are being loaded.

In a terminal organization of considerable size, branch receiving and distribution located in the wholesale districts might be advantageous, part of the vehicle equipment being garaged at such branches at night. Thus, trucks loaded with inbound freight might continue to leave the terminal up to the close of the day, completing delivery from the branches the first thing in the morning. Trucks having picked up incoming loads toward the close of the day need only run to the branch that night, completing delivery to the terminal next morning. Empty mileage would be reduced to the minimum.

One of the stumbling blocks in the way of centralized terminal haulage is the question of charges for the service. It has been rather definitely established by the Interstate Commerce Commission that carriers may not absorb charges for service of this nature in the freight tariffs despite the fact that the express companies and the postal service do so. If this obstacle cannot be removed, it is by no means insurmountable. Charges sufficient to pay the cost of the service can be levied on a zone basis and still be so much lower than current trucking rates as to discourage the use of private cartage facilities entirely. Should it be necessary to continue to accommodate such outside vehicles, the warehouse offers practically limitless space for the reception of vehicles and without interfering with the free movement of freight between ships, railroad warehouses and the terminal's own motor trucks.

Perhaps the most difficult problem confronting the plan is the delays which are occasioned by consignees' failing to unload the vehicles promptly and by shippers delaying the loading of outbound matter. This is encountered to a considerable extent by the express companies and improvement in this respect would doubtless effect important economies.

One way to do this would be to follow the practice of the taxicab companies. The taxicab fare is nominally on a mileage basis, but to prevent loss through excessive standing time, an extra charge is made for each 10 minutes of waiting after the first 10 minutes. The railroads allow a reasonable time for a car to be loaded or unloaded and then charge demurrage. Demurrage could be charged to shippers in a similar manner: a minimum free time of 15 minutes for 3 tons and under, and 5 minutes additional for each additional ton being allowed, and 10 cents (0/5) a minute for all demurrage time.

Making marine freight terminals efficient is less a matter of architecture than of method. Present designs of piers in American ports are necessarily based upon present methods of freight transfer. Excepting the more flimsy wooden structures most of the permanent piers constructed in recent times have the virtue of size and so can be adapted in some measure to more efficient systems of freight movement. Undoubtedly with a change of system, marine terminals to be constructed later on will be designed to harmonize more perfectly with the most modern methods.

But while not the most important factor to efficiency the design of terminals has a great bearing on the development of methods that are possible. Two of the most efficient marine terminals in America today are the Army Base Terminal in South Brooklyn, N. Y., and the Los Angeles Municipal Terminal at San Pedro, Cal.

That the tendency in construction is distinctly toward more efficient arrangement is indicated by the character of new projects now under construction. Another Army enterprise which is now about completed is the $15,000,000 (£3,060,000) waterfront Army terminal at New Orleans which has been released for general storage and shipping purposes. It is capable of storing 178,500 tons of freight or the approximate volume of 10 days' movement over a the public wharves at the port. It comprises three 6-story warehouses, each 140 by 600 feet, adjoining each of which is a wharf house 140 by 2,000 feet, double-decked and connected with the warehouses by multiple-deck connecting bridges.

A $10,000,000 (£2,050,000) warehouse for foodstuffs at Long Island City, N. Y., is projected, involving warehouses covering 15 acres of ground ten stories high, with

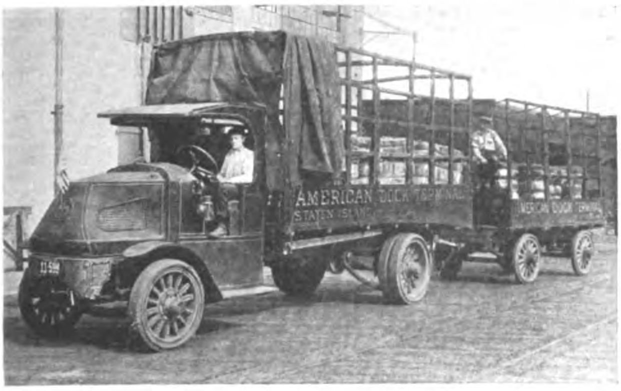

Fig. 18.—The American Dock Company Adopted Troy Trailers for Its Three Trucks in Order to Eliminate Horses from Its Service, the Purpose Being to Haul from 1½- to 2-Horse Wagon Loads per Truck Trip

dockage facilities for ships up to 35 feet draft and equipped with freight elevators capable of raising loaded freight cars.

Trend in Freight Terminal Planning

That the trend in freight terminal planning is distinctly toward more efficient vehicular movement of freight is indicated by the fact that at this Long Island City warehouse the plan is to load motor trucks on the various warehouse floors and transport the freight directly to the doors of wholesalers in the Metropolitan district of New York and New Jersey. The New York Port and Harbor Commission has appointed a committee to study into labor-saving freight-handling devices in connection with the planning of new terminals and improvements in methods at present ones. The same commission is reconsidering the store-door delivery plan.

Army Base Terminal at South Brooklyn

Four piers and two warehouses comprise the Army Base terminal at South Brooklyn. The first of these piers is for car floats, the remaining three being for steamships. Each of these piers is approximately 150 feet wide by 1,300 feet long, double-decked, and connected with the warehouses by two-way bridges. Each pier is double-tracked down its center and is equipped with six elevators. They are separated by slips 250 feet wide, and from the first of the two broadside warehouses by a paved bulkhead 260 feet deep, extending the width of all the piers.

The warehouses are parallel to the shore, each 980 feet long. That nearest the water is 200 feet wide; the other, directly behind it and connected by two-way bridges and tunnels, 306 feet wide with a court in the center. In addition to these buildings there is a boiler house at the northern end of the bulkhead and a large office building, fronting at the foot of Fifty-eighth street.

The terminal has trackage for 1,080 cars aside from through tracks to be kept clear connecting with the Long Island Railroad and the Bush Terminal Railway. In the rearmost, or warehouse *B*, facilities for 50 freight cars in the courtyard are provided. This building has 1,800 feet of vehicle platform space, 900 feet incoming and 900 feet outgoing. The other, or warehouse *A*, has 1,100 feet of vehicle platform space, the combined capacity of both sets of platforms being 290 vehicles loading and unloading at a time.

In addition to six 5-ton elevators, each pier has a locomotive crane of 20 tons capacity, which is given ample room in which to maneuver by the 30-foot headroom allowed on the main floor. Each, furthermore, has a 2-ton traveling crane running the full length.

Warehouse *A* has thirty 5-ton elevators, 10 by 18 feet each, arranged in three groups, each of which is operated by distant control by a single operator, guided by electric signals.

Warehouse *B* has forty-two of the same size of elevators, similarly controlled by three operators, each of whom runs fourteen by means of push buttons. In the courtyard of warehouse *B* are four high-speed electric traveling cranes, by which freight may be raised from the cars on the tracks below to landings or balconies on each of the seven upper stories. Whip hoists may also be used in this court.

Each of the six bridges and three tunnels connecting the two warehouses with the three main piers has two separate passages, each capable of accommodating the largest type of interior electric tractor. Interior transportation equipment comprises:

25 Automatic electric industrial trucks;
47 Mercury four-wheel electric industrial tractors;
1,000 Lansing industrial trailers, four-wheel, designed especially for use with Mercury tractors and capable of tracking exactly in any length of train which the tractor is capable of handling;
5,000 feet of roller gravity conveyor sections for car and truck unloading and loading.

For yard use and work between the Army base warehouses and those of the Bush Terminal adjoining:

17 Walker 5-ton electric trucks;
23 Walker towing tractors;
4 Walker 2-ton crane tractors;
150 heavy four-wheeled yard tractors having platforms 42 inches by 14 feet, with low wheels, platform 14 inches from the ground;
5 railroad switch engines;
2 gasoline (petrol) truck cranes, 5-ton.

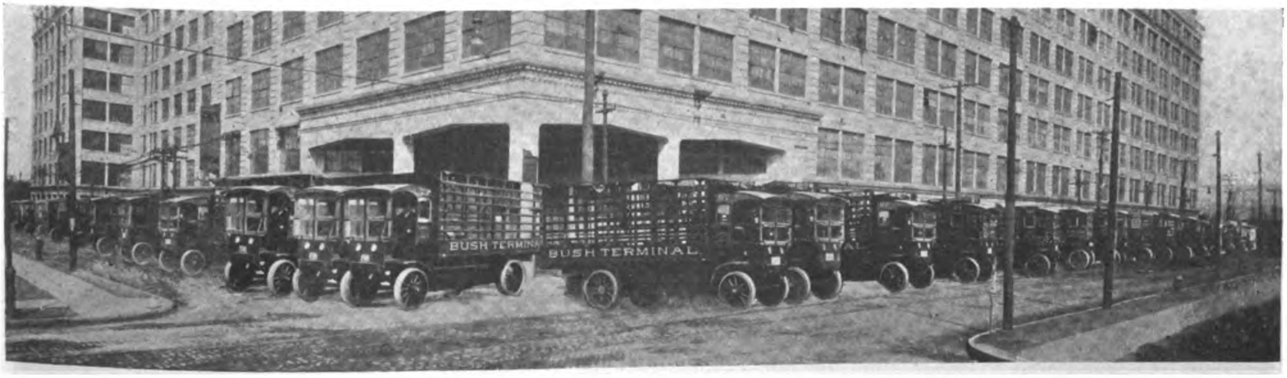

Fig. 19.—Fleet of Walker Electric Trucks Used by Bush Terminal, in Front of the Newest Bush Loft Building—the Largest Reinforced Concrete Building in the World. These Trucks Are Used for Local Delivery, Pick-Ups and Transfers

For transportation between the Army base and other terminals in the port, such as the 2-mile trip to the other end of Bush Terminal, the 7-mile haul to the Hoboken piers of the Army Transport Service and to Governor's Island:

40 Liberty, or Class B, 3-ton Army trucks;
1 Riker 4-ton truck;
1 Mack 5½-ton wrecker.

In the basement of warehouse *A* are gasoline (petrol) and electric garages, the former capable of storing 100 heavy trucks and having two tanks of 11,000 gallons of gasoline (petrol) each. The electric garage has a complete electric charging equipment, arranged with wall plugs to boost the batteries during idle periods, and a large reserve battery room.

With this equipment and the 4,000,000 square feet of floor space afforded by the warehouses, the terminal has turned over 4,000 carloads of freight in a month, with an inadequate force of soldier laborers. The method of handling the freight is some indication of the systems that must be used in future if America is not to fall behind in international trade.

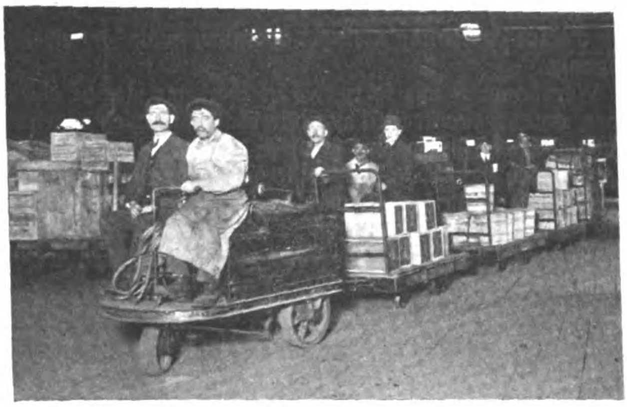

Fig. 20.—Mercury Industrial Tractors in Use by Pennsylvania Railroad at New York Terminal. This Type of Tractor Is Used for the Interior Trucking at the Army Base Terminal. It Is Able to Handle Trains Upwards of Eighteen or Twenty Cars Long, Each Trailer Tracking Exactly with the Tractor Through Tortuous Turns, Due to Castor Front Wheels on the Trailers and a Special Draft Connection

On arrival at the terminal, a ship is moored to a pier the lower deck of which has been cleared, the upper deck containing perhaps an outbound cargo. The ship is unloaded onto this clear lower deck, the freight being moved away from the edge as fast as it is swung overside by the ship's cranes or cargo masts on the pier. Here the cargo is classified, inspected, etc., and then moved off the pier by one of several means, depending upon its class and destination.

Carload stuff for immediate shipment is loaded directly into the freight cars spotted on the central railroad tracks down the center of the pier shed. As fast as these cars are loaded they are pulled out and placed on sidings ready to be made up into trains for movement the same evening, perhaps. These may be run directly over the Long Island Railroad lines or onto car floats for transfer to railroad terminals about the port.

Less-carload freight and articles for immediate local delivery may be loaded directly into waiting motor trucks and delivered to destination or to railroad freight terminals or transfer stations.

Freight to be lightered to other ships or other waterfront warehouses may be moved directly across the pier to lighters waiting on the other side.

Matter for transfer to Bush Terminal warehouses may be loaded directly into trailers for electric tractors, or into gasoline (petrol) trucks.

Matter for immediate rail shipment to various points in through cars of mixed freight, such cars being loaded on other piers or in or about the warehouses, is loaded onto trailers and hauled by the electric tractors to the cars.

The rest of the cargo, which is to be stored or held in the warehouse for later distribution, is raised to the upper floor by the elevators after being loaded on the industrial trailers, which are there made up into trains and hauled into the warehouses by the industrial tractors.

Warehouse Elevator Service

Freight of various classes is stored on different floors of the warehouses. The tractors pull their trailers to the elevators on the main floor of one or the other warehouse, passing over the bridges or through the tunnels between the two to reach warehouse *B*. Arriving at the elevators, the tractor uncouples its train, or such part of it as is destined for that elevator group, picks up any trailer waiting for transfer to other shafts and proceeds, eventually securing a return train for the pier, when possible. The elevator crew loads the trailers onto designated elevators which are destined in advance for the proper floor, and on closing the door the elevator operator is notified by an electric light signal and moves the elevator.

Arrived at the upper floor, the trailers are taken from the elevator and made up into trains by the elevator crew for that floor. A tractor operating on that floor picks up the completed train and hauls it to the proper department, where it is unloaded by a special crew, the trailers being loaded again with other goods destined elsewhere.

By this means the cargo is kept moving away from the ship's side as fast as it is unloaded. Every article of freight moves directly and continuously to its destination and with the minimum number of loading and unloading operations. The rolling stock is kept employed continuously and empty trips are cut to the minimum. The tractors keep moving constantly and practically never have to wait for trains to haul. The elevators are loaded and unloaded quickly and without rehandling of the goods.

Goods Scientifically Segregated in the Warehouse

The goods in the warehouse are segregated scientifically and the office knows at all times where every article is located. When requisitioned for shipment, a crew is sent to load it on empty trailers.

If it is to go to a pier for a cargo being made up, the process just described is reversed to the point where the goods reach the upper floor of the pier, where they are held pending arrival of the ship.

If for carload shipment, the trailers are hauled either to an outside car door or to the inner court of warehouse *B* for loading, the loading operation being facilitated by the gravity roller conveyors.

If for l.c.l. shipment in through cars being made up of mixed loads at the terminal, it will be hauled to the car door by the tractors if possible, or, if not, transferred to a large trailer or gasoline (petrol) truck at one of the platforms. The latter method would be used for transfers to the Bush Terminal.

If for local delivery in the Metropolitan district, the trailers would be hauled to one of the outbound loading platforms of the warehouse and loaded onto a gasoline (petrol) truck, which would make direct store-door delivery.

Inbound land freight, either for the warehouse or for direct marine shipment, would follow the same lines as

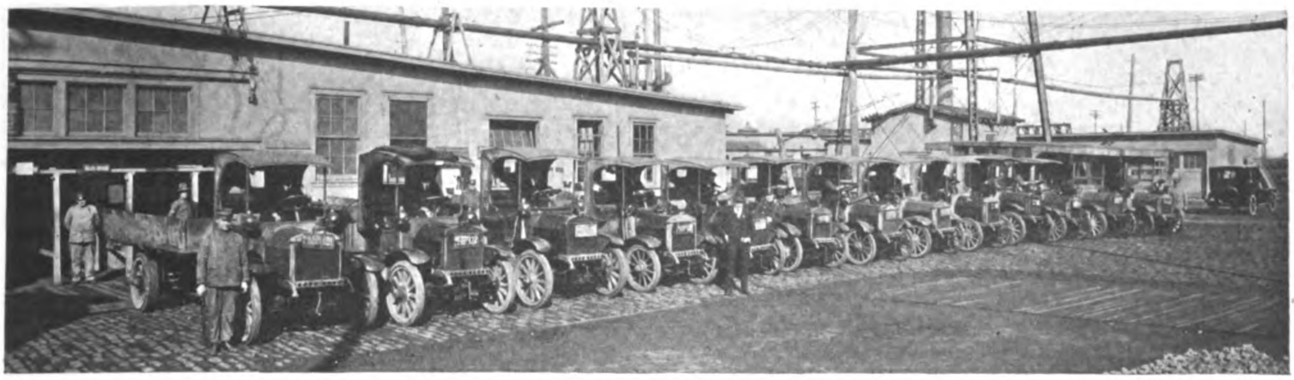

Fig. 21.—Fleet of Federal Trucks Operated by the Submarine Boat Corporation, Port Newark, N. J.

above in a reversed direction, save that different vehicle platforms are provided for outbound and inbound shipments.

Returning to the ship, which we left unloading: In the event that it is to take on another cargo and leave immediately after being loaded, loading could commence as soon as the last sling of inbound cargo had been deposited on the pier, the outbound goods coming down the pier elevators from the upper floors where the outbound cargo is assembled; or, the outbound cargo on the upper floor could be loaded into an outbound ship on one side of the pier while an inbound cargo was being taken from the ship on the other side.

Loading an Outbound Cargo

In a pinch, assuming all of the piers to be occupied with outbound cargo and an extra cargo to be made up for a waiting ship bound for a different destination from that intended for the made-up cargoes, matter in the warehouse could be moved to the pierhead by means of the efficient interior mechanical transportation equipment at even greater speed than it can be loaded into the usual type of ocean freighter.

Further improvement of these methods is possible, of course, nor is it claimed that the entire scheme above outlined is always followed at the Army's terminal, but the above represents what is possible with facilities which have now existed in the port of New York for more than a year.

For example, the Lansing trailers might be replaced with a transveyor or lift truck type which would handle false platforms upon which the loads would be piled when first unloaded from the ship, car or vehicle, and upon which they would remain until loaded into an outbound carrier. Or they might as well be halves or thirds of sectional demountable truck bodies which, while equally useful as indoor trailers, would also be truck bodies and would save rehandling on the loading platforms. The two suggestions might even be combined, the demountable truck body sections replacing the false platforms and being moved about either by lift trucks or by overhead electric telphers.

Railroad car elevators might be installed in such warehouses by which entire carloads could be spotted right on the upper warehouse floor where the goods were to be stored and carloads could be loaded directly from the warehouse section into the car.

The connecting bridges between piers and warehouses might be supplemented by tunnels running into basements of the piers and warehouses, so that inbound matter would

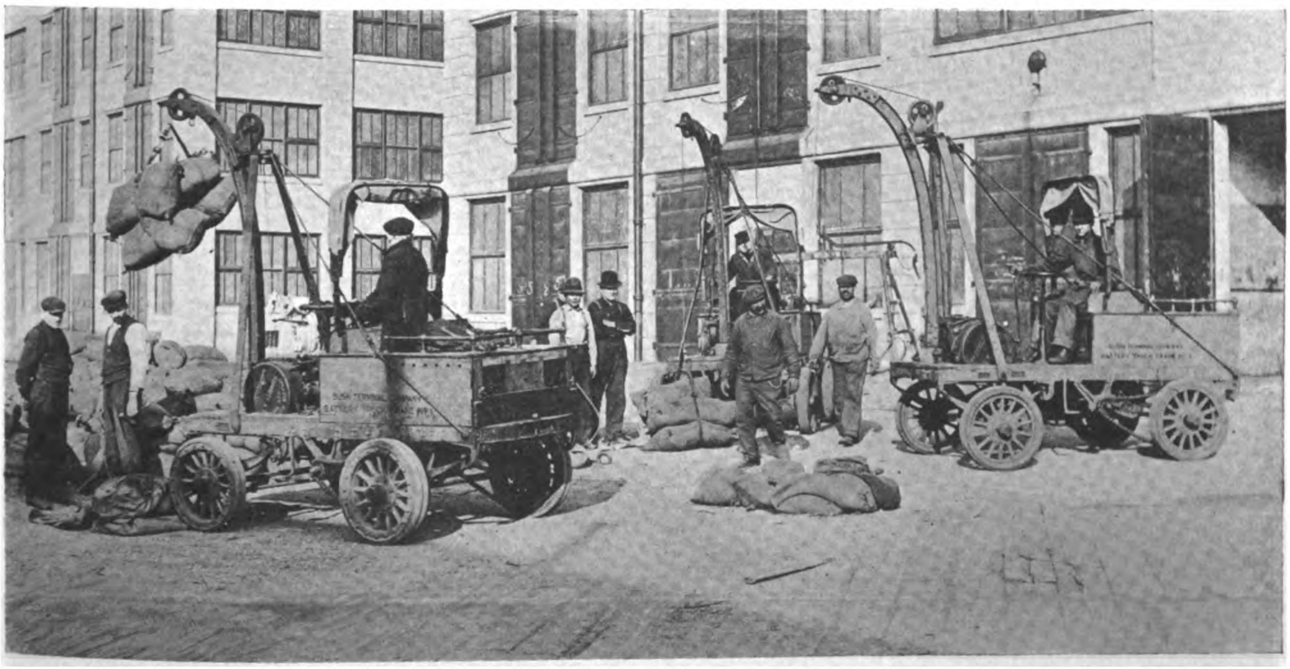

Fig. 22.—Electric Crane Tractors a Convenience in Handling Bulky, Unwieldy Goods, by Which It May Be Loaded Directly Into Freight Cars, Onto Motor Trucks or Direct to the Ship's Sling

be transferred from the main deck of the pier to the waiting warehouse trailers by gravity chutes instead of elevators. The incoming industrial trains would then pass through the tunnels and the outbound over the bridges, gravity escalators transferring the tractors and trailers from the second floor to the basement. Gravity chutes from the second floor could deliver outbound cargoes to the pier edge. Gravity is cheaper and faster than any arrangement of elevators.

Greater efficiency of elevators in the warehouse might be obtained if gravity chutes were used for a large proportion of the downward movement of freight from the upper floors and the elevators were equipped with an automatic return control, so that when the door of an upper floor is opened and closed again the car will automatically return to the main floor.

Instead of trundling the freight to exterior loading platforms for transfer to street vehicles, there might be advantages in having elevators to raise the vehicles to the different floors for direct loading and unloading.

No better indication of the great possibilities that lie in motor transportation at marine freight terminals can be found than in the cases where, even under the miserable conditions now prevailing, motor trucks owned by terminal-operating companies have proved successful.

> "Making marine freight terminals efficient is less a matter of architecture than of method. Present designs of piers in American ports are necessarily based upon present methods of freight transfer. Excepting the more flimsy wooden structures, most of the permanent piers constructed in recent times have the virtue of size and so can be adapted in some measure to more efficient systems of freight movement. Undoubtedly with a change of system, marine terminals to be constructed later on will be designed to harmonize more perfectly with the modern methods."—Merrill C. Horine.

Motor Transportation at the Bush Terminal

Best known among these is the Bush Terminal Company, South Brooklyn, N. Y. About 15 percent of the freight passing over Bush bulkheads is transported by motor trucks. Of course this percentage is low, compared with what may be expected at general terminals, because so much of the Bush business concerns tenants on the Bush properties. The Bush organization employs an extensive fleet of electric and gasoline (petrol) trucks, the electrics predominating for city deliveries. The Bush company uses its vehicles for direct or store-door delivery of freight in a radius of 35 miles. This service is not confined to l.c.l. shipments, furthermore: but where quick delivery of larger shipments is demanded, the trucks are the only satisfactory means of rendering it.

The Wilmington Steamboat Company, operating the Wilson Line steamers between Philadelphia and Wilmington, Del., at one time encountered lively competition from the numerous inter-city motor express lines between its terminals. It wisely chose to fight trucks with trucks and installed store-door delivery and receipt of shipments at the Wilmington end. While no such service was rendered at the Philadelphia end, none was needed because the motor express companies themselves required that goods be brought to their central collecting stations in that city.

Five Packard gasoline (petrol) trucks of from 3 to 6 tons capacity, one Kelly-Springfield of 3½ tons, a 1-ton Ford and five 2½-ton electric trucks were installed successfully. A definite charge for the trucking service on a 100-pound schedule was made and most shippers found it more economical to pay this than to attempt their own trucking under the usual partial-load conditions.

One of the principal reasons for the mushroom growth of inter-city motor express lines and their signal success in many instances is that the long terminal delays are eliminated and the demand for store-door delivery and receipt is met. Consignors are willing to pay a higher rate for quicker time in transmit. The Wilson Line was able to give almost equal service in point of speed at very much lower rates than the motor truck operators could quote. The fact that the Wilson Line trucks have almost a monopoly of freight handling to and from its ships is eloquent testimony of the economy of terminal-operated trucks over privately owned ones, even under present conditions.

The American Dock Company, operating two terminals on Staten Island, New York harbor, has experimented to a certain extent with the operation of its own trucks. The result of this experience has been that, while owing to customs now prevalent this operation has not been highly successful, or worth while extending, it has demonstrated the possibilities of motor truck use where controlled by the terminal company.

From the showing made by the six trucks and three trailers used so far, it has been learned that 300 trucks controlled by the terminal, could be kept busy at the American Dock and Pouch terminals operated by this concern, and could take over all the vehicular transportation work required by the traffic. It is declared that if shippers could be induced to turn over all of this work to the American Dock Company, these 300 trucks could give better and cheaper service than the shippers' own or contracted vehicles.

This is because less clerical work, with its attendant delays and expense, would be necessary than at present. The trucks would be garaged at the terminals, where the work originates and much waste mileage would be saved, owing to the fact that return loads would be the rule rather than the exception that they now are.

These conclusions are based on the assumption that the trucks would be used for local delivery and collection of freight, trans-shipping of l.c.l. freight between American terminals and others at the port, for store-door delivery and receipt of freight from and to the warehouses and for the elimination of free lighterage. By the latter is meant that with efficiently operated motor transportation small shipments could be transferred between steamship and railroad terminals more expeditiously and more economically even than possible at present.

A possible extension of this service would involve longer than local hauls, shipments from and to points as far distant as Albany, N. Y., Philadelphia, Bridgeport and intermediate points being transferred by motor direct from the shipper's door to the steamship side in days where weeks are now involved. Privately owned trucks now carry a considerable traffic of this nature, sometimes by contract with regular inter-city motor express lines and sometimes in the vehicles of manufacturers and wholesalers themselves.

A project of this sort cannot be carried out under present conditions because no preference can be given motor trucks over horse vehicles; no regulation of load, such as would bring about full loads on a relatively few vehicles rather than partial loads on many, is possible; and because of present ferry delays, due to the excessive amount of traffic of horse vehicles occasioned by the low load factor and slow speed.

So obstructive are present conditions to progress that the American Dock Company has not even been able to displace horse wagons in its own service, finding that traffic conditions eliminate any advantage motor trucks might possess in any but the longer hauls. The equipment now operated comprises three 5½-ton Mack trucks, three 1-ton Fords and eight two-horse wagons. Four more trucks could handle all of the work done by the wagons, if conditions permitted it.

The American Dock Company's estimate on the number of vehicles required to handle all of the trucking is conservative, since trucks on each pier and to all warehouses connect directly with all railroads via a railroad bridge over Kill Van Kull to the New Jersey mainland. Terminals situated less fortunately for railroad connections would undoubtedly find a greater proportionate volume of motor transportation necessary.

In an effort to do the work of the American Dock horse vehicles economically with the Mack trucks, trailers have been tried. By their use it was hoped that a sufficiently large load per trip could be made to offset the decrease in average speed occasioned by traffic and slow ferriage. To pay, a truck must make a minimum of two trips per day, one trip being sufficient for the horse wagons. In the work which is done by the horse wagons, a motor truck is unable to make more than one trip per day. Troy 2½- and 3½-ton trailers were used, therefore, in an effort to make 1½ to two-horse wagon loads per motor truck trip, since the truck with a trailer is able to proceed through traffic about as fast as alone. Owing to difficulties with ferries and some of the docks which prohibit the use of trailers, this has not been entirely successful.

There is no doubt that the type of ferry boats in use in New York militate considerably against efficient motor truck use in terminal haulage. As most of them are today constructed, there is a double driveway down the center of the main deck, with passenger cabins at the side, most of them having no accommodations on the upper deck. Those which have passenger cabins on the upper deck still retain those on the lower deck, though the upper cabins are always adequate for the crowds. The result of this restricted vehicle accommodation is that during rush hours it is sometimes necessary for trucks to wait in line from 1½ to 3½ hours before getting on a boat.

One of the East River ferries has four driveways on each boat, the passenger cabins on the lower deck having been eliminated. The passengers occupy the upper deck exclusively and leave and board the boat by upper gangplanks. They are thus out of the way of vehicular traffic and the capacity for vehicles is doubled.

There is no royal road to terminal efficiency, else it would have been traveled long since. But there is a key to the situation, and that is motor trucks. Big tonnage on the water, big tonnage on the railroads, high speed at both places—these things spell economy because they save time and labor. To realize their advantages to the full, they must be linked up by road vehicles of big tonnage and high speed, as compared with the horse vehicles making their last stand at city terminals today.

Shipping Policy.—The executive committee of the National Merchant Marine Association has adopted and submitted to the members of the council for action the following recommendations:

That so many of the steel vessels of desirable commercial types now owned by the Government as are not needed for the immediate development of new trade routes should be sold for operation under the American flag to American individuals, or to firms, corporations or associations a majority of whose stock is owned by American citizens.

That vessels of other types be sold as rapidly as possible, without restriction as to flag or purchaser, but giving preference, on equal terms, to American purchasers.

That pending their disposition by sale, Government vessels should, as far as possible, be chartered upon a basis favorable to successful operation, to American individuals, firms, corporations or associations, and that the lessees be given options to purchase said vessels within a reasonable time.

That until sold or chartered, Government-owned vessels should be operated by the Government.

Crude-Oil Motors vs. Steam Engines in Marine Practice*

BY J. W. MORTON

THE number of articles which have appeared of late describing the performances of the so-called motorships would seem to indicate that for marine purposes the crude oil motor is rapidly replacing the steam engine. The chief reason for this is not to be found, as might be expected, in the lower operating cost of the crude oil motor, but is rather due to other factors which, when considered, lead to the conclusion that the crude oil motor is probably the most economical prime mover of today.

Perhaps the correctness of this statement can best be shown by comparing a steamship with a motorship. In the case of a war vessel, for instance, there are eight factors which ought to be considered in choosing the form of motive power, namely, weight, space occupied, radius of operation, preparedness, crew necessary, fuel, auxiliary equipment, and cost.

The weight of the power plant is of great importance, for a saving therein can be utilized to increase the armor of the ship. If, for example, a warship of 3,500 tons displacement be equipped with crude oil motors, there will result a saving as indicated by Table 1, which is based on a single steam engine developing 4,400 horsepower and three units, of 1,600 horsepower each, of a standard make of crude oil motor.

In the case cited, about the same space would be required for both motor plant and steam plant, but the total horsepower could just as well be developed by two units of slightly larger size, and if this were done approximately one-third the space would be saved. Moreover, if oil motors were used, the space occupied by the coal bunkers could be partially released, as crude oil can be stored in tanks under the engine floor and below the protective line.

It is obvious that a warship must possess a great cruising radius, and if weight for weight of engines be con-

TABLE 1.—COMPARATIVE WEIGHTS OF POWER PLANTS IN STEAMSHIPS AND MOTORSHIPS

	Steamship	Motorship	Savings in Motorship	
			Weight, Tons	Percent
Engine, tons	335	264	71	...
Percent of displacement	9.6	7.5	...	2.1
Fuel, tons	246	86	160	...
Percent of displacement	7.0	2.5	...	4.5
Crew, provisions, water, tons	91	82	9	...
Percent of displacement	2.6	2.3	...	0.3
Totals	672	432	240	6.9

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* From a paper read at the spring meeting, Detroit, June, 1919, of the American Society of Mechanical Engineers.

sidered, then the ratio R of the cruising radii of a steamship and a motorship may be expressed by the formula

$$R = \frac{V_c \times H_o \times W_c}{V_o \times H_c \times W_o},$$

where

V_c = cubic feet occupied per ton of coal = 45.
V_o = cubic feet occupied per ton of oil = 35.
H_c = British thermal units per pound of coal = 14,000.
H_o = British thermal units per pound of oil = 18,500.
W_c = pounds coal consumed per effective horsepower-hour.
W_o = pounds fuel oil consumed per effective horsepower-hour.

In the case of the warship under consideration, if W_c be taken as 1.75 and W_o as 0.4, then the ratio will be

$$R = \frac{45 \times 18{,}500 \times 1.75}{35 \times 14{,}000 \times 0.4} = 5.7.$$

The cruising radius will, of course, vary with the type of engine and ship, but, nevertheless, the average ratio, as expressed above, may be taken at least as 1 to 5 in favor of the crude oil motors.

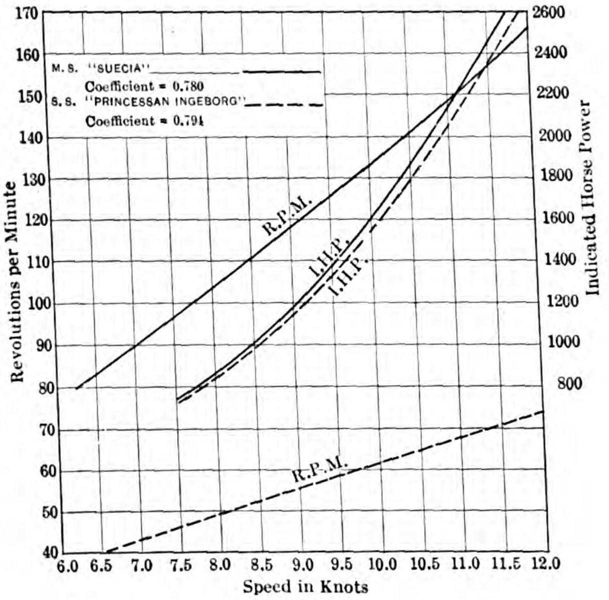

Fig. 1

A motorship, in sharp contrast to the steamship, is always ready for action, as no time is lost in getting up steam. Moreover, fuel is consumed only when the motors are running, and the motorship is capable of maintaining full speed as long as there is a supply of fuel.

As there is no need for stokers on a motorship, the crew can be decreased about 10 percent, and this, of course, permits of a corresponding saving in provision, water storage and quarters.

In the case of a steam-driven warship, the smoke from the stack frequently betrays the location of the ship, for it is well known that a vessel can be easily located by its smoke long before the masts or hulls are in sight. Another drawback to the steam-driven warship lies in the fact that the smoke covers the ship with a film of soot which, getting into vital parts of auxiliary machinery, necessitates frequent cleaning and unnecessary wear and tear. On the other hand, when oil is used there is no smoke, the handling of the oil is both cleaner and easier, and the life of machinery and equipment is greatly increased.

When a change is made from steam to oil the auxiliary machinery is usually electrically driven, as this has been found to be most satisfactory. The dynamos are usually driven by separate oil motors. Hot water for heating and sanitary purposes is obtained from a small oil-fired boiler, and, while the first costs of such installations are high, they are in time offset by the lower operating costs.

Prior to the war the first cost of a crude oil motor plant was approximately twice that of a steam plant. This was partly offset, however, by the savings in operating expenses, under which item comes cost of fuel, labor and supplies. The cost of fuel naturally depends upon the prevailing market for coal and oil. In regard to maintenance, there is practically no information available, as the crude oil motor is still in its infancy so far as this country is concerned.

CARGO SHIPS

Many of the preceding statements concerning the installations of crude oil motors on battleships can also be properly applied to cargo ships. During the last four years a number of such vessels have been equipped with crude oil motors of both the two-stroke and four-stroke cycle type, and, while engineers are not agreed as to the best type, the four-stroke cycle is to be preferred.

One of the most successful installations of this kind is that on the motorship *Suecia*. This ship has a length of 362 feet, a beam of 51 feet 3 inches, a depth of 25 feet 6 inches, and a capacity of 6,550 deadweight tons. It is provided with twin screws driven by two 1,000-horsepower Diesel engines of the 8-cylinder 4-cycle type, and also with two auxiliary engines of 200 horsepower each. The vessel was built for service between Sweden and La Plata and its first run was a test made on December 4, 1913. The curves in Fig. 1 give some idea of the characteristics of the motors. The dotted curves are given for the sake of a comparison with the steamship *Princessan Ingeborg,* built two years before the *Suecia* and for the same company. The *Princessan Ingeborg* has a length of 300 feet, a beam of 48 feet 9 inches, a depth of 22 feet 4 inches, and a capacity of 5,890 deadweight tons. The block coefficient for the *Succia* is 0.78 and for the *Princessan Ingeborg* 0.794, and thus both vessels are about equal in size and excellence. A comparison will show that the same amount of power is necessary to obtain equal speeds when the displacements are equal. This would seem to indicate that there is no difference between transmitting power through two small comparatively fast-running screws as is done on the motorship, and transmitting power through a single slow-running screw as in the case of the steamship. The propeller on the steamship has a diameter of 17 feet, while those of the motorship are only 10 feet. The ratio of indicated to effective horsepower is therefore the same for both ships, and the total efficiency of engines and propellers is also about the same.

In order to correspond to the motorship in horsepower, the steamship would be obliged to carry an extra boiler This would increase its weight 570 tons, whereas the weight of the machinery on the motorship is only 47 tons. The length of the engine room of the motorship is 41 feet, while the length of the engine room and necessary boilers in the steamship is 66 feet, and this despite the fact that the steamship has less horsepower.

MOTOR SIZES

The fuel consumption during the trial trip of the *Suecia* was 0.2948 pound per indicated horsepower, or 0.368 pound taking the mechanical efficiency at 80 percent, a very satisfactory value.

The horsepower of a crude oil motor, whether of the constant volume or constant pressure type, is somewhat limited by practical considerations of construction. At the present time the maximum size is 2,500 horsepower per shaft and from six to eight cylinders for the two- and four-stroke cycle constant pressure type, although some experimental engines have been built as large as 6,000 horsepower. This is in sharp contrast, however, to the power developed by steam, which runs as high as 15,000 horsepower for the steam engine and 35,000 horsepower for the steam turbine.

Crude oil motors of small horsepower are usually of the high-pressure type, medium, so-called semi-Diesel or hot-bulb type and two-cycle constant volume type. Prominent among such semi-Diesel engines are the Bolinder, Scandia, Avance, Alliance, Tuxham, Gidion and Holm.

It has been proved both by experiment and practice that the constant volume, high-power, single-cylinder type of motor is unsatisfactory, and chiefly because of the fact that the enormous heat generated at the pistons during the explosion must travel a great distance before it is transferred to the water jacket, and as a result the central part of the piston is heated to such an extent that pre-ignition frequently occurs. Furthermore, the sudden rise in pressure sets up detrimental vibrating stresses in the material, and it is also exceedingly difficult to obtain a proper mixture of air and oil, rapid ignition and complete combustion and exhaust.

On the other hand, the constant pressure oil motors of high power must have numerous cylinders all of the same size, and the high pressure, which lasts approximately 10 percent of the stroke, necessitates a careful design of the crank mechanism. This applies especially to the crankshaft, which is both difficult and costly to produce. Moreover, in motors with only a few cylinders, the flywheel must be heavy, large and expensive if a great variation in speed is to be cared for. Difficulties have also been encountered in keeping the piston leak-proof; if it fits too tightly the result is a large frictional loss, and if the clearance is too great there will be a loss of pressure. The greater the piston area, the more effective must be the cooling system, as the surface exposed per pound of working medium decreases as the cylinder dimensions increase. This accounts for the lower thermal efficiency and the horsepower available per unit of piston surface with large cylinders.

The Design of Shackles and Long Chain Links

BY ARTHUR RAYMOND

That a chain is only as strong as its weakest link is an adage as well known to the lay-mind as to the technical one. Shackles, special long links, swivels, etc., are as much a part of a chain as the many standard size links that make up the most of the chain itself. Ordinarily, a designer experiences no difficulty in determining the proper size chain (made up of links, shackles, etc.) to use for a given working load, as there are ample tables, curves, etc., compiled by commercial concerns in their publications and similar data found in handbooks to cover a large range of working stresses. However, the writer recently had quite a little designing on shackles and long chain links to take care of heavy loads beyond the upper limit of those usually tabulated as mentioned above.

The formulae that were available gave results that obviously were much too large, and if used would have given an uneconomical use of material and money, and, besides, would reflect badly upon the reputation of the engineer.

After exhausting the formulae in text books without attaining the desired end, letters of inquiries were sent to a number of professors and other capable men, but their replies were unsatisfactory in that they either treated the subject only for the fundamental principles involved or else duplicated some of the information that was already at hand.

In the meantime the writer deduced empirical formulae for the design of shackles and long links based on breaking tests. These formulae apply not alone for special cases, but also within the limits of the tables on shackles, links, etc., found in hand books.

Shackles

For straight-jaw shackles the formula is:

$$d = \sqrt[3]{.00008503Pl},$$

where

d = diameter of wire in inches.
P = safe load on shackle in pounds.
l = span in inches.

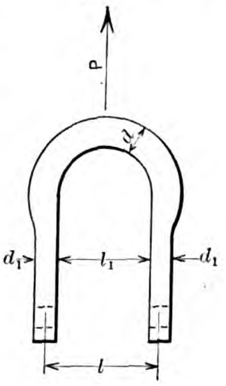

Fig. 1

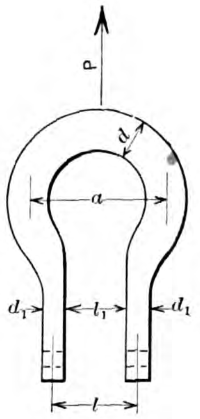

Fig. 2

This formula is based on a working stress of 10,000 pounds per square inch (factor of safety 6).

For bow shackles increase d found by above formula by 10 percent.

In proportioning the shackle (see Fig. 2), a should never be greater than $2l$, and preferably less than $2l$. d is obtained by designing each prong to take $\frac{P}{2}$ in tension and adding 25 percent to take care of any eccentricity of loading.

In designing the pin, the best results are obtained by proportioning it to a bending moment equal to $\frac{Pl}{6}$.

Long Links

The formula for long links is very simple and gives good results:

$$A = \frac{P}{1.25 \times S},$$

where

A = area of wire in square inches.
P = safe load on link in pounds.
S = working stress in pounds per square inch (tensile).

The use of these formulae proved quite satisfactory, and they are given to the readers of this technical publication who may have experienced similar difficulties.

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The Naval Architects' Meeting

DURING the war the annual meetings of the Society of Naval Architects and Marine Engineers were necessarily handicapped on account of the small amount of time which many of the members engaged in war work could give to the work of the society. In spite of this, much information that was of value and importance was brought out at the meetings and the increase in membership and attendance was highly gratifying. Now that the imperative demands of war work have ceased there is an opportunity to make the forthcoming annual meeting of the society, which will be held in New York on November 13 and 14, a memorable occasion. Sufficient time has elapsed so that the gigantic deeds of shipbuilding and shipping accomplished in the short space of two years can be reviewed in their true perpective and valuable lessons learned from an analysis of these strenuous efforts. The programme of the technical meetings, we are assured, will include some of the most important papers ever presented before the society, and an opportunity will be given for excursions to the large shipyards and marine establishments in the vicinity of New York where the tangible results of the two-year period of war activity can be investigated at first hand.

As Others See Us

OUR attention has been called to the following item published in the September issue of our British contemporary *The Steamship:*

"The main trouble with American shipyards is that their managers failed to rise to the opportunity to advertise themselves to the world at a time when they were flush with orders and making profits. They failed to invest money to create a goodwill, such as that possessed by foreign establishments, which kept their advertisements going in the technical journals when their works were being operated by the Government and no one could prophesy when the plants would again be available for commercial use. This shortsightedness is in evidence in practically all of the leading lines of American industry, and, with few exceptions, which could be counted on the fingers of one hand, the best American shipbuilding and engineering firms are almost unknown quantities abroad, which are nowhere surpassed and in but few instances equaled."

The reading of this item perhaps will do no harm to the faint-hearted new-comers in the American shipbuilding industry, who, during the months of plenty, have hesitated to advertise their facilities for fear that they would get work which at the instaant they could not handle, and who have paid no attention to the fact that war work would soon be over. As a further hint to the faint-hearted, it may be mentioned that the first contract placed in an American yard by a neutral nation after the armistice was signed went to a shipbuilding company which has consistently advertised its facilities in the marine press before, during and after the war. Who will be the next?

The American Seagoing Merchant Fleet

THE seagoing fleet of American merchant ships of over 1,000 gross tons each on August 31, 1919, registered for the foreign trade or enrolled for the coasting trade by sea, as shown by the returns of the Bureau of Navigation, Department of Commerce, comprised 2,245 ships of 8,100,008 gross tons, of which 1,558 of 6,707,820 gross tons were steel steamers, 347 of 840,611 gross tons were wooden steamers, 95 of 180,487 gross tons were steel sailing vessels or schooner barges, and 245 of 371,099 gross tons were wooden sailing vessels or schooner barges. Of the steel steamers, 123 of 1,046,840 gross tons were of 7,000 gross tons each or over, 249 of 1,583,229 gross tons were from 6,000 to 6,999 gross tons each, and 251 of 1,392,926 gross tons were of 5,000 to 5,999 gross tons each. The largest wooden steamers were of less than 4,000 gross tons each.

According to reports issued by the Shipping Board on September 13 the American flag floats from the mastheads of 1,280 oceangoing ships, 1,107 of which were built by the Shipping Board. Up to the outbreak of the war, the United States had only fifteen vessels of 1,000 tons and over engaged in overseas trade. In June, ,1914, according to the same report, the total gross tonnage under the American flag, including coastwise shipping and the fleet operating on the Great Lakes, was 4,287,000 gross tons. In June, 1919, its gross tonnage was 11,983,000, an increase of 278 percent, chiefly in oceangoing ships.

The steam tonnage under the American flag now comprises 24.8 percent of the steam tonnage of the world. In the four years preceding the war the shipyards of this country turned out a total of 107 seagoing vessels of [illegible] tons and over, this construction representing [illegible] deadweight tons. During 1918 there were launched in the yards under the control of the Shipping Board a total of 4,216,656 deadweight tons, five times more than had been built in the four pre-war years. From January 1

1919, to August 29, 1919, 3,983,135 deadweight tons of shipping have been launched and 3,845,140 deadweight tons delivered, making a total for the twenty months of 8,199,791 tons launched and 6,925,233 delivered.

The original construction programme contemplated the building in this country of 17,807,071 deadweight tons of shipping. Of this total 1,292 ships, with a deadweight tonnage of 7,125,225, have been delivered. There are fitting out in wet basins 408 steamships of 1,920,000 deadweight tons and, on the ways 497 ships of 3,286,105 deadweight tons. Steel steamships numbering 227, of 1,476,610 deadweight tons, are under contract but upon which work has not yet begun. The total contracts canceled called for 886 vessels of 4,515,285 deadweight tons. At the end of August, the total seagoing vessels under control of the Shipping Board numbered 1,280, with a deadweight tonnage of 7,706,400.

Propeller Data from the New Mexico's Trials

In a paper by Commander S. M. Robinson, U. S. N., fleet engineer of the Pacific fleet, published in the current issue of the *Journal of the Society of Naval Engineers,* some interesting information in regard to propellers and propulsion generally is given that was obtained from the trials of the electrically propelled battleship *New Mexico*. Two sets of trals were held, the first after the ship had been out of dock about seven weeks and the second just after the ship had been docked. It was found that there was a difference between the two trials of about 4,250 shaft horsepower at 21 knots, or an average increase of resistance of about 9.6 percent, due to the foul condition of the ship's bottom. This experience was corroborated in the case of the battleship *Pennsylvania*, and it is pointed out that fouling occurs very rapidly in the first few weeks that a ship is out of dry dock, and that after that the rate of increase of resistance due to fouling falls off very rapidly.

As the *New Mexico* is driven by four screws, trial runs were made with two screws, first the inboard and then the outboard, idle and perfectly free to turn. It was found that the increase of effective horsepower due to the dragging of two screws varied from 36.4 percent at 7 knots to a minimum of about 13 percent at about 12½ knots, and that the percentage was still increasing at 15 knots, which was the highest speed of the ship obtained under these conditions. These results, it is held, should convince anyone of the futility of trying to save fuel by providing a multiplicity of screws and engines and reducing the number in use as the speed of the ship is reduced. The saving due to increase of engine efficiency will be only a very small fraction of what is lost due to the increase in resistance due to the dragging screws. In the case of the *New Mexico,* at 15 knots it required about 2,400 more shaft horsepower with two screws than with four screws, or an increase of 26 percent in horsepower.

In this connection another point was brought out. The data showed that the idle propellers drag at between 60 and 65 percent of the revolutions required to drive the ship at the given speed; at a speed of about 7 knots the screws ceased to revolve. As this percentage seems to be about the same for all types of ships, it offers a very easy method of plotting retardation curves simply by observing the revolutions of the engine from instant to instant and obviates the necessity of obtaining the actual speeds of the ship by bearings. It is noted that when running with two screws the dragging screws run at approximately one-half of the revolutions made by the driving screws.

A further comparison of the performance of the inboard and outboard screws showed that more power was required for the same speed by the inboard screws than by the outboard screws, and paradoxically, the revolutions per minute in the inboard screws were less than that of the outboard. The apparent paradox in regard to the revolutions, Commander Robinson points out, is easy to understand, as there is a small difference in the "slip block coefficient" for inboard and outboard screws, which will, of course, slightly affect the basic speed and slip of the two screws. The difference in horsepower, while not so easy to explain, is due to the fact that the inboard screws cavitate sooner than the outboard. It is pointed out that on a four-screw ship it is possible, when driving with two screws only, to load these very much more heavily before cavitation takes place than can be done when driving with four screws, although the slip of the screw is more than twice as great with the two-screw condition than with the four-screw condition.

What Do You Think?

Since the first of the year numerous reports have been circulated in various quarters to the effect that large numbers of American Government-owned ships are laid up in dry dock, both in this country and abroad, for repairs, and that in general American vessels built during the war and now owned by the Government are not giving a good account of themselves in actual service. The chairman of the Shipping Board has not hesitated to deny these reports vigorously, and to express the opinion that such statements are very probably part of a propaganda to depreciate the prices of American vessels now being sold by the Shipping Board. Other Shipping Board officials have pointed out that these reports are calculated to result in setting high rates for insurance on American vessels, which would handicap them in competition with vessels of foreign registry.

According to reports that have reached this office ninety-nine steel ships owned by the Shipping Board are undergoing repairs in the New York harbor. All of these vessels, with the exception of a few former German ships, have been constructed during the war.

Based upon the average conditions of summer service, is such a volume of repair work excessive? If so, why is it necessary? Is it on account of poor workmanship, faulty equipment, "rush conditions," or incompetent operators? What do you think?

Letters from Marine Engineers

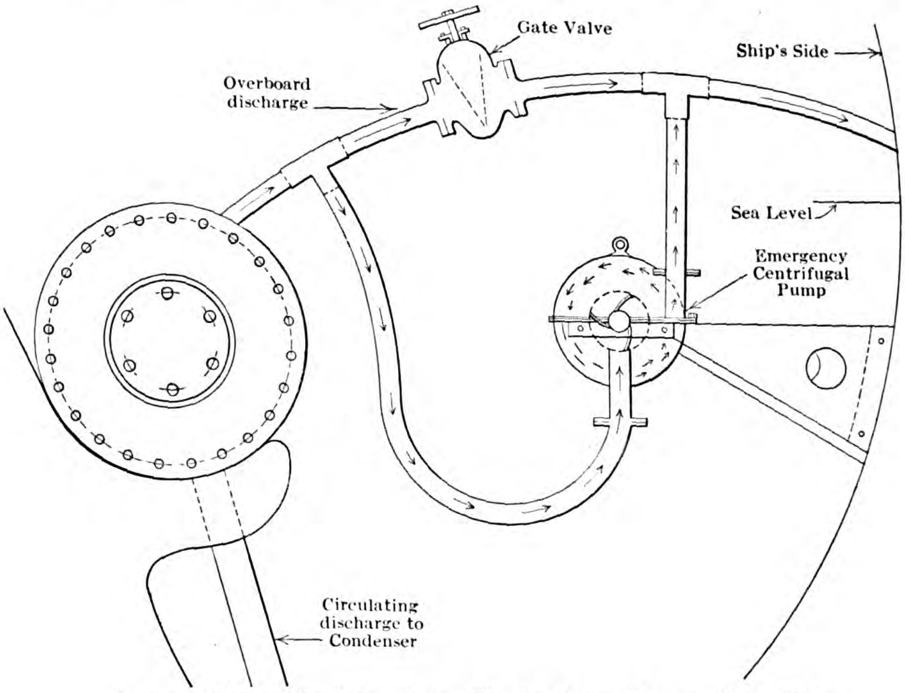
Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Repairing a Water-Circulating System

An interesting and ingenious precaution taken in anticipation of a breakdown in the main circulatng pump of the steamship *Opihi* was brought to the attention of the writer recently. While getting ready in Lyttelton, New Zealand, for a long voyage to Vancouver, a bad crack was found at the base of the circulating pump. By means of the electric welding outfit a fairly good job was made in repairing the crack, but, as the cast iron was rather badly corroded, the chief engineer did not altogether like the idea of placing too much dependence on this repair.

In the yard of the engineering works near the dock he found a second-hand centrifugal pump, which was installed in the following manner: The pump was placed on a platform behind the engines about 18 inches below the sea level. The overboard discharge pipe in the condenser was cut and a gate, or sluice, valve fitted to it. Between the gate valve and the condenser a tee was put on the pipe and the connections from the discharge pipe led to the suction of the centrifugal pump, while the discharge from the latter was led into the main discharge pump through another tee piece on the other side of the gate valve. In the event of the circulating pump chamber giving out on the main engines, it could be kept watertight by means of canvas; then, if the valves were taken out of the pump, the gate valve on the discharge pipe closed and the centrifugal pump started, the condenser would become a suction type. This means that, in spite of the water being forced through the condenser by the circulating pump on the main engines, it would be drawn through by the suction of the centrifugal on one side of the gate valve and discharged on the other. The great advantage of this idea was that, with the main engine stopped, the ship, having no winch condenser, the exhaust from the engines driving the dynamo, pumps, winches, etc., could be led into the main condenser, which would take the place of an auxiliary condenser. The valves would, of course, have to be taken out of the circulating pump on the engines to allow for the uninterrupted flow of sea water to the condenser. By starting up the centrifugal, the main condenser would now become a winch condenser and save exhausting into the atmosphere with the corresponding loss of water.


Gate Valve
Ship's Side
Overboard discharge
Sea Level
Emergency Centrifugal Pump
Circulating discharge to Condenser

Section of Water Circulating System Showing Where Repairs Were Made

Luckily, the repair on the circulating pump held out, but it was a great relief to the chief engineer to know that he always had another circulating pump if needed.

Vancouver, B. C. EDMUND B. DELL.

A Comparison of Ship Performances

Seafaring men, shipowners and engineers will no doubt be interested in an account of the performance of the two ships *Opouri* and *Opihi*, which, although entirely different in characteristics, had the same set of engines and boilers installed at different times.

Some years ago the *Opouri* was wrecked outside the port of Lyttelton, New Zealand. Because of the shortage of ships during the war, an enterprising firm bought her with the idea of salvaging the boilers and engines and installing them in another boat.

At low tide a hole was cut in the side of the *Opouri* and the boilers rolled out of her. By a similar method the engines were recovered. A German barque, the *Opihi*, over forty years old, was then purchased and it was decided to place the salvaged engines and boilers in this old sailing ship. The following data will enable the reader to see at a glance the performance of each vessel:

S. S. Opouri

Length	170 feet
Beam	27 feet
Depth	12 feet
Indicated horsepower	560
Powered with triple-expansion engine, 15 inches by 25½ inches by 41 inches by 2 feet 6 inches stroke.	
Carrying capacity	750 tons
Fuel consumption, per day	13 tons

In smooth coastal waters on a 30-day run, consuming 13 tons of coal a day, the vessel averaged 9.5 knots.

S. S. Opihi

Length	210 feet
Beam	34 feet
Depth	21 feet
Indicated horsepower	560
Powered with the same triple-expansion engine as the *Opouri,* 15 inches by 25½ inches by 41 inches by 2 feet 6 inches stroke.	
Carrying capacity	1,620 tons
Fuel consumption, per day	10 tons

This ship, with twice the carrying capacity, averaged 8.4 knots, with a fuel consumption of 10 tons per day for a 15-day run. On a run of 37½ days from Lyttelton to Vancouver, a distance of 6,920 miles, she consumed 393 tons of coal and averaged nearly 7.7 knots throughout the voyage, in spite of the fact that bad weather was encountered most of the time.

Vancouver, B. C. EDMUND B. DELL,
Canadian Pacific Railway,
British Columbia Coast Service.

A New System of Dry Docks

A new dry dock system has been evolved to facilitate the emptying of a dock and to utilize the otherwise waste water in partially filling an adjacent dock. In the operation of dry docks, it is the common practice, after a vessel has been floated into position and properly shored, to pump out the water in order to leave the dock in condition for working purposes. This pumping forms quite a considerable item in the cost of operation, while a relatively long time is wasted in getting started on the actual repair or reconstruction work.

The new system consists of several docks arranged side by side and interconnected by conduits, as shown in Fig. 1.

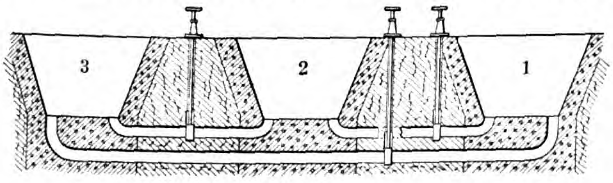


Fig. 1

These ducts serve to transfer water from one chamber to another as required. Each conduit is provided with a gate valve, the stem of which extends upward through the earth or concrete and terminates in an operating lever or wheel. The valve may also be of the solid type, operating in a guide built into the inclosing wall.

With three docks the method of operation is quite simple. After dock No. 1 is full and the ship to be repaired floated into place (*A*, Fig. 2) the valves connecting docks Nos. 1 and 2 are opened and the water flows from one to the other until a common level is reached (*B*, Fig. 2). To further reduce the level in dock No. 1, the valves between 1 and 2 are closed and those between 1 and 3 opened. This time the water reaches a common level in 1 and 3 (*C*, Fig. 3) and leaves but a small amount in dock 1 to be pumped out. With a greater number of connecting docks the pumping necessary is reduced to a very small amount.

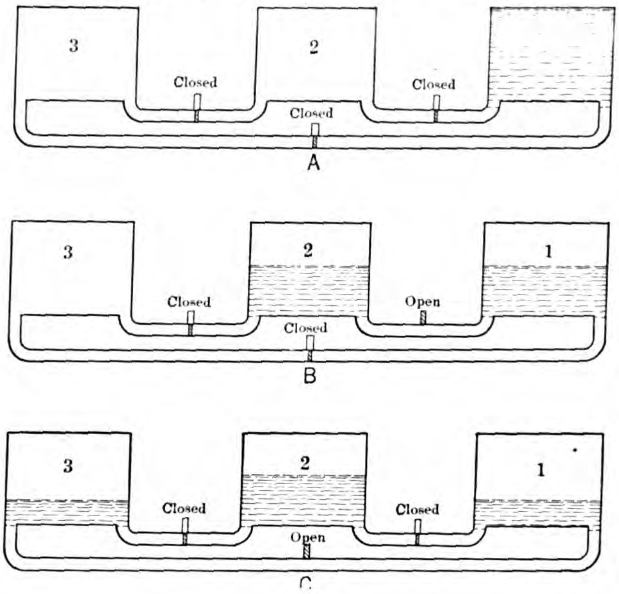


Fig. 2

It can readily be seen that in a large docking system a considerable number of combinations are possible when the docks are connected. Schedules of repairs may be so arranged that one dock is always flooded and in a receiving condition, while others are simultaneously ready to discharge a vessel or vessels.

Philadelphia, Pa. JOHN LAKE.

Pump Signal

I went over to Jerry's plant one afternoon to get his book on boilers. While I was there he was rigging up a pump signal from the pump room to the engine room to tell him at all times whether the pump was operating or not. I considered the scheme pretty nifty and sketched it down to pass along. A piece of board was fitted up with a couple of spring prongs or contacts and bolted to the top tie rod near the end of the slide valve rod. The latter was fitted with a taper steel wedge, as shown in Fig. 1. Each time the pump made a double stroke it made a contact with the spring prongs, as shown at *A-B*. A light was wired up to hang over the log desk in the engine room in circuit with this apparatus, so the man on watch could always note the signal working and rest easy about the pump.

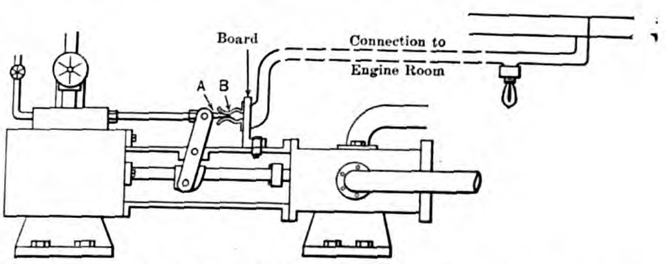
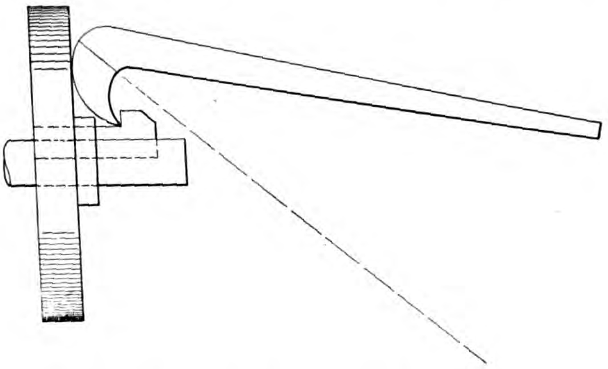


Fig. 1.—Slide Valve Rod Fitted With Taper Steel Wedge

Concord, N. H. CHAS. H. WILLEY.

Device for Pulling Keys

A lever that has proved useful in pulling out keys is shown in the accompanying sketch. It was made from a 2-inch by 1-inch steel bar about 24 inches long, tapered at one end, and with a rather sharp hook at the other. The bar is sufficiently strong so that it may be tapped with a hammer if necessary to start the key.



Lever Made From Steel Bar for Pulling Keys

Worcester, Mass. E. M. PETERSON.

The Qualifications of a Marine Engineer

The early days of steam possess an interest all their own. Recently the writer had the privilege of perusing an early volume of a long-extinct periodical called *The Artisan,* for the year 1843.

This was one of the earliest industrial journals, and, although its interests were very wide in range, engineering activity occupied a large space.

The extract given below has lost none of its moral during the passage of 76 years, although it may make quaint reading. It touches upon the prime duty of blowing down due to salt water feed, a practice now almost unknown. The "depositure of scale," as the extract has it, is not lessened by the admission of larger quantities of sea feed, although the pressure carried at that date was insufficient to give the temperature requisite to precipitate sulphates.

The journal was perfectly serious in tone, was representative of the steam practice of its day, and a large part of its interest lies in a series of plates depicting marine and other engines. It may be added that regular steam packet communication with America was not then established, although a number of steam vessels had made the voyage. There is grave discussion in its pages as to whether such service could be made to pay as a commercial venture. The best-recorded coal consumption in its pages is 8 pounds coal per horsepower hour, and as bunkers had to serve for the double passage it was considered that the ship could not carry sufficient coal to be safe, leaving aside consideration of cargo.

London, England. A. L. HAAS.

QUALIFICATIONS OF A STEAM BOAT ENGINEER

(*The Artisan,* November, 1843.)

It is not book learning that is required in the engineer of a steam vessel, but care, good sense, and self-possession; and in the proportion in which he possesses these qualities is his eligibility to be estimated. For the want of assiduous care no other quality can compensate, but this quality will go for little if there be a want of skill and penetration, or timidity in the hour of danger. A vast number of lives are in the engineer's hand, and such a responsibility should only rest upon one who is prepared to try all things and to dare all things when the occasion is such as to demand his energies.

The attention to the feeding and blowing off of the boilers is the engineer's most important duty. In sea-going vessels, blowing off should be practiced every two hours—that is, twice every watch. It is a mistake to suppose that this frequent blowing off diminishes the pressure of the steam, for, although there is more water to heat in consequence, the difference is more than made up by the greater facility with which sea water yields steam than concentrated brine. Besides, unless the blowing off be frequent, the depositure of scale on the flues so impairs the conducting power of the metal that a large quantity of the heat which would otherwise enter the water escapes up the chimney. There is no more important qualification of a nautical engineer than to be prepared with remedies for all the conceivable disasters likely to happen to steam vessels at sea. Thus, if the vessel were to spring a leak, the obvious resource would be to open the injection from the bilge; but suppose that both injection hoses were to become choked with coal dust within the condenser, as we have known under such circumstances to happen, what would be resorted to then? In such a case the injection should be admitted through the snifting valves, supposing the water high enough to reach them, the condensation being thereby accomplished in the air pump instead of the condenser. Again, suppose the eccentric catches were to give way—a thing by no means infrequent—it is pleasant beforehand to know that the proper motion will be given to the slide by the lever of the opposite engine, or by the cross-tail butt, or connecting rod of the same engine; and every engineer should settle in his own mind, after a survey of the engine with which he has to deal, what expedient he would adopt in such an emergency.

Plugs for Leaky Condenser Tubes

The customary practice of placing wooden plugs in leaking condenser tubes reduces the condensing surface and obstructs the passages. One means of overcoming the difficulty is to make plugs from a 1-inch hexagonal brass bar, as shown in Fig. 1.

The length of the plug illustrated is approximately correct. The diameter would have to be varied to fit the tube to be repaired, so that the latter might be made absolutely tight. The section *A* has 28 threads per inch.

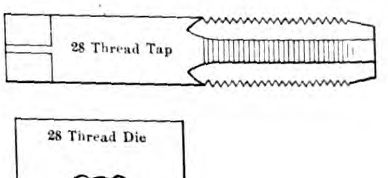


Fig. 1

Section *B* is tapered 1/32 inch per inch, while *C* is a ¼-inch fillet on the top of the plug. A ⅜-inch or larger hole is drilled through the plug to prevent obstructing the tube. Fig. 2 shows a special tap and die to be used in cutting out the plugs.

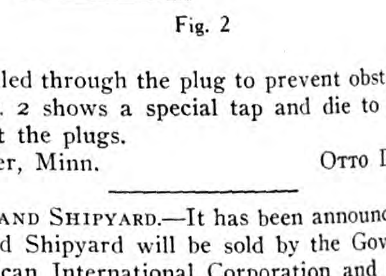


Fig. 2

Stillwater, Minn. OTTO DORTHEN.

HOG ISLAND SHIPYARD.—It has been announced that the Hog Island Shipyard will be sold by the Government to the American International Corporation and that it will be converted into a great transatlantic terminal, similar to the Bush terminal in New York.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in this Department

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Appendage Resistance

Q. (1022).—Having the model basin results of the resistance of a model, with a certain appendage on it, at speeds corresponding to speeds of from 6 to 16 knots of the ship, we made a run with the appendage off at a speed corresponding to 11 knots of the ship. The difference between the run with the appendage on and the run with the appendage off gives the resistance absorbed by the appendage at this particular speed (11 knots). I should like to know some method whereby I may determine the resistance absorbed by the appendage at other speeds on the resistance curve, other than running the model with the appendage on and off as above.

A. (1022).—In considering the problem of appendage resistance, it should be realized that appendage resistance in ordinary vessels is a minor matter. Admiral Taylor in his work "Speed and Power of Ships" suggests that the appendage resistance for a single-screw vessel will rarely be greater than four or five percent of the bare hull resistance, and for a twin-screw vessel this value might reach twenty percent.

The law of comparison does not hold for all parts of appendage resistance, which is made up of resistance due to bar and bilge keels, rudders, shaft bossings, blunt stem or stern frames and spectacle frames. (The resistance of such appendages as stem and stern post can be found, but for items like the bilge keel, where stream line motion comes into play, the model results cannot be safely used.) If desired, the appendage resistance at any speed can, in your case, be approximated by assuming that it varies as the square of the speed. However, since the appendage resistance will not follow this law, it will be preferable (until this subject is more clearly understood) to approximate it by comparing the calculated bare hull resistance of the ship with the total resistance of the ship as obtained from the trial.

Measurement of Vacuum

Q. (1023).—I have been using thermometers in the exhaust trunks as vacuum gages, using the temperatures given in the steam tables. Is this right, and do the temperature and pressure of steam in the exhaust trunk correspond with that given in the steam tables?

As I see it, no corrections are necessary if the barometer is up or down. Is this true?

I have used the following scale. Is this right?

29.6	54.0°	28.7	88.0°	27.8	105.0°
29.5	58.0°	28.6	90.0°	27.7	106.5°
29.4	63.0°	28.5	92.0°	27.6	108.0°
29.3	67.0°	28.4	94.0°	27.5	109.0°
29.2	71.0°	28.3	96.0°	27.4	110
29.1	75.0°	28.2	98.0	27.3	112
29.0	79.0°	28.1	99.5°	27.2	113.0
28.9	82.0°	28.0	101.0°	27.1	114.0
28.8	85.0°	27.9	103.0°	27.0	115.0°

A. (1023).—Although it is a common practice to use the Burdon gage for measuring vacuum, you are quite right in using the thermometer for this purpose. The temperature and pressure in the ordinary steam tables are for dry saturated steam, but as these are independent of the quality, the effect of change of the quality is to vary the specific volume and heat contents. This method of obtaining the pressure in the condenser has been used quite frequently, especially in some experiments in the design of condensers, on which Mr. D. B. Morrison has written several papers. Care should be taken, however, that the thermometer is placed in a well located at the top of the exhaust trunk or the top of the condenser, as placing same in a lower position will cause greater discrepancy, due to the fact that the mixture of air and water vapor contains more air further down.

Your data as reported in the log should refer everything to atmospheric pressure. Boiler pressure gage would require that the atmospheric pressure be added to express the result in pounds per square inch absolute. Likewise, the vacuum obtained by the manometer (U-tube of mercury) would require that the barometer be read in order to allow for the atmospheric pressure. In other words, the atmospheric pressure is being used in both the above cases as the datum plane of measurement. If the steam tables were used directly, a certain temperature would give you a corresponding absolute pressure in pounds per square inch, which can be converted into inches of mercury above zero, absolute pressure.

As most of your data in the log is in pounds per square inch gage, it would theoretically not be correct to use your table, due to the fact that it is based upon the barometer registering 30 inches, which latter will vary from day to day. The following example will serve to bring out this point quite clearly:

Find range of pressure for a low-pressure turbine, admission pressure 20 pounds gage, temperature of exhaust trunk 98 degrees F., barometer, 29.7 inches..

Steam chest pressure at turbine 14.6 + 20.0 .... = 34.6 pounds per square inch absolute
Pressure in exhaust trunk (see steam tables) .... = .9 pound per square inch absolute
Range of pressure .... = 33.7 pounds per square inch

Using your scale, we have:

Steam chest pressure at turbine = 34.6 pounds per square inch absolute
Pressure in exhaust trunk i. e., pressure corresponding to 28 inches of mercury (14.6 — 13.85 = .75 pound) .... = .75 pound per square inch absolute
= 33.85 pounds

You will note that your scale will undoubtedly give an approximate vacuum, but it does not take account of variations in barometer. With the idea of greater accuracy, I would suggest that the first column in your table be subtracted from 30 to give absolute pressure (unit inches of mercury). If, then, these readings are subtracted from your barometer reading, we have the correct vacuum with but little more trouble than would be caused in using your scale, as at present. Of course in turbine work every tenth inch of vacuum will cause a corresponding improvement in the turbine operation, so that correct reporting of vacuum readings is important.

DISPOSAL OF LARGE GERMAN LINERS.—The former Hamburg-American liner *Imperator* has been turned over to the Cunard Line by the British Ministry of Shipping to be operated on the express mail service between New York and Southampton with the liners *Aquitania* and *Mauretania*. It is expected that the *Leviathan* will be turned over to the International Mercantile Marine Company.

Shipbuilding and General Marine News

Contracts for New Ships—Shipyard Improvements—
Engineering Projects—Improved Appliances—Personal Items

132,000 TONS OF STEEL ORDERED FOR AMERICAN AND FOREIGN SHIPBUILDING

$80,000,000 for Foreign Tonnage. Bidding Active on Tankers

Reports issued by the steel companies show that 32,000 tons of steel have been ordered from plate mills for the construction of steel tonnage recently contracted for. Inquiries have now been received concerning an additional 100,000 tons of ship plates, 50,000 tons of which will probably be constructed in the United States. A rough estimate of $80,000,000 has been given as the expenditure for foreign ships to be built in this country and abroad.

P. A. S. Franklin, of the International Mercantile Marine, has announced that orders have been placed with Harland & Wolff, Belfast, Ireland, for 200,000 tons of freight and passenger vessels.

Eastern shipyards have been asked to bid on eight steel tankers ranging from 8,000 to 11,000 tons. A rumor appearing in the *Wall Street Journal* states that two oil companies have asked bids on six tankers of 10,000 tons each. The Atlantic, Gulf & West Indies Company, 11 Broadway, New York, is asking prices on twelve tankers.

Contract Let for Two Freighters

The Todd Shipyards Corporation, 15 William street, New York, has received a contract to build two 227-foot vessels for the Donald Steamship Company, Inc., 17 Battery Place, New York. The ships will be 33 feet 8 inches in beam, 15 feet molded depth, of about 1,200 deadweight tons. They will be equipped with two oil-fired boilers, operating under forced draft. Triple expansion engines will be installed developing 1,400 horsepower. The vessels will make 12½ knots.

Naval Architect Prepares Plans for $50,000,000 Worth of Vessels

Theodore Ferris, naval architect and marine engineer, 30 Church street, New York, is now engaged in preparing designs, plans and specifications for various merchant ships—cargo vessels, passenger steamships, colliers and bulk oil ships, which in value will exceed $50,000,000 when constructed. He is also working on several large reconstruction and alteration propositions for passenger ships and some fifteen coal-burning vessels which are being converted into oil burners.

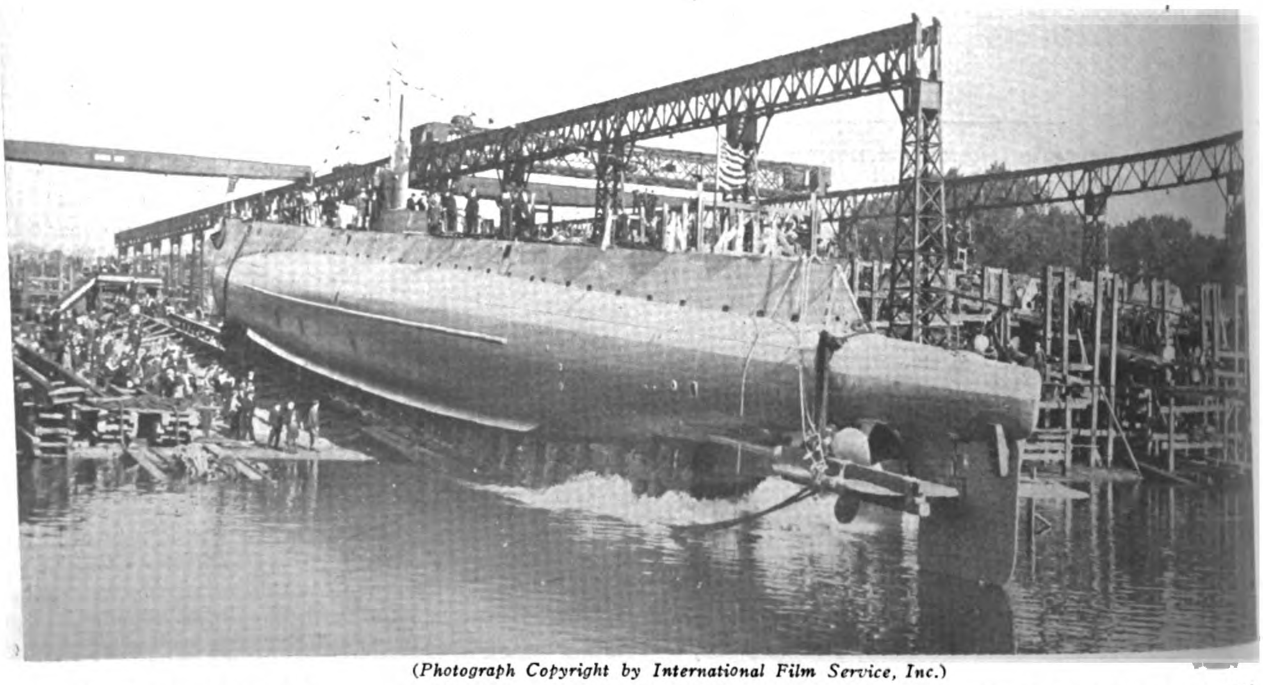
FRANCE TO SPEND $375,000,000 FOR MERCHANT MARINE

French Representative in America Unable to Report on American Contracts

On August 10 the French Cabinet consented to the introduction of a bill authorizing the expenditure of 1,380,000,000 francs ($375,000,000) in the reconstruction of the French merchant marine. On August 29 we were advised by Commander Bricard, chief construction engineer connected with the French Commission in America, 65 Broadway, New York, that no definite decision had been made regarding the allotment of construction orders to American yards.

Commander Bricard said: "It is utterly impossible to give you the French programme of marine construction because many questions are not yet settled, among which is the amount of tonnage that will be given by Germany. Before the settlement of this question we cannot give an approximate allotment of French orders between the United States, England and France."

In this connection it may be noted that French steamship owners have recently purchased forty vessels from the British Government at a total cost of £7,500,000 ($31,000,000).



(*Photograph Copyright by International Film Service, Inc.*)

Launching the United States Submarine *AA*-2 at the Bethlehem Shipbuilding Corporation's Fore River Plant. This 400-foot Vessel, Which is Equipped With Diesel Engines, is Designed to Make 18 Knots on the Surface and 13 Knots Submerged

STEAMSHIP COMPANIES READY TO PLACE ORDERS FOR SHIP TONNAGE DESIGNED FOR SPECIAL SERVICES

Matson Navigation Company Will Build Several Vessels—J. S. Emery & Company to Contract for Ten Vessels—Swedish Representatives Here to Ask Bids on Tramp Steamers—Other Cargo Tonnage Planned

The reports received from various parts of the country show that ship operating companies are about ready to place contracts for vessels to be used in special services. From an authentic source we learn that J. S. Emery & Company, Inc., 114 State street, Boston, Mass., is about to place a contract for ten vessels.

The Matson Navigation Company, San Francisco, Cal., we learn from reliable authority, will place orders in the near future for one large 20-knot passenger steamship, and several smaller passenger and freight steamships, of slower speed.

The United Fruit Company, 131 State street, Boston, Mass., is planning to build a number of fruit and freight steamships for use in the West Indies service.

Representatives of the Swedish-American Line are reported to be in this country in an endeavor to place contracts for at least two passenger steamships of the Stockholm type. The American representatives of this company are Furness, Withy & Company, 34 Whitehall street, New York.

In addition, the General Petroleum Company, which maintains headquarters at San Francisco and Los Angeles, operating oil fields in southern California, is planning to place a large fleet of oil steamers on the California-Seattle oil routes.

The Ocean Mail Steamship Company, San Francisco, Cal., plans to build three or four new vessels for San Francisco-South American service.

Sun Shipbuilding Company Will Build 10,000-Ton Vessel for Dutch Interests

The Sun Shipbuilding Company, Chester, Pa., has received a contract to build a 10,000-ton steel passenger and cargo vessel for Dutch interests. The steamer, which will have accommodations for 2,500 passengers, is intended for Pacific and East Indian trade and as an immigrant steamer from Rotterdam and Amsterdam to Dutch possessions.

Submarine Boat Corporation to Build Fabricated Ship

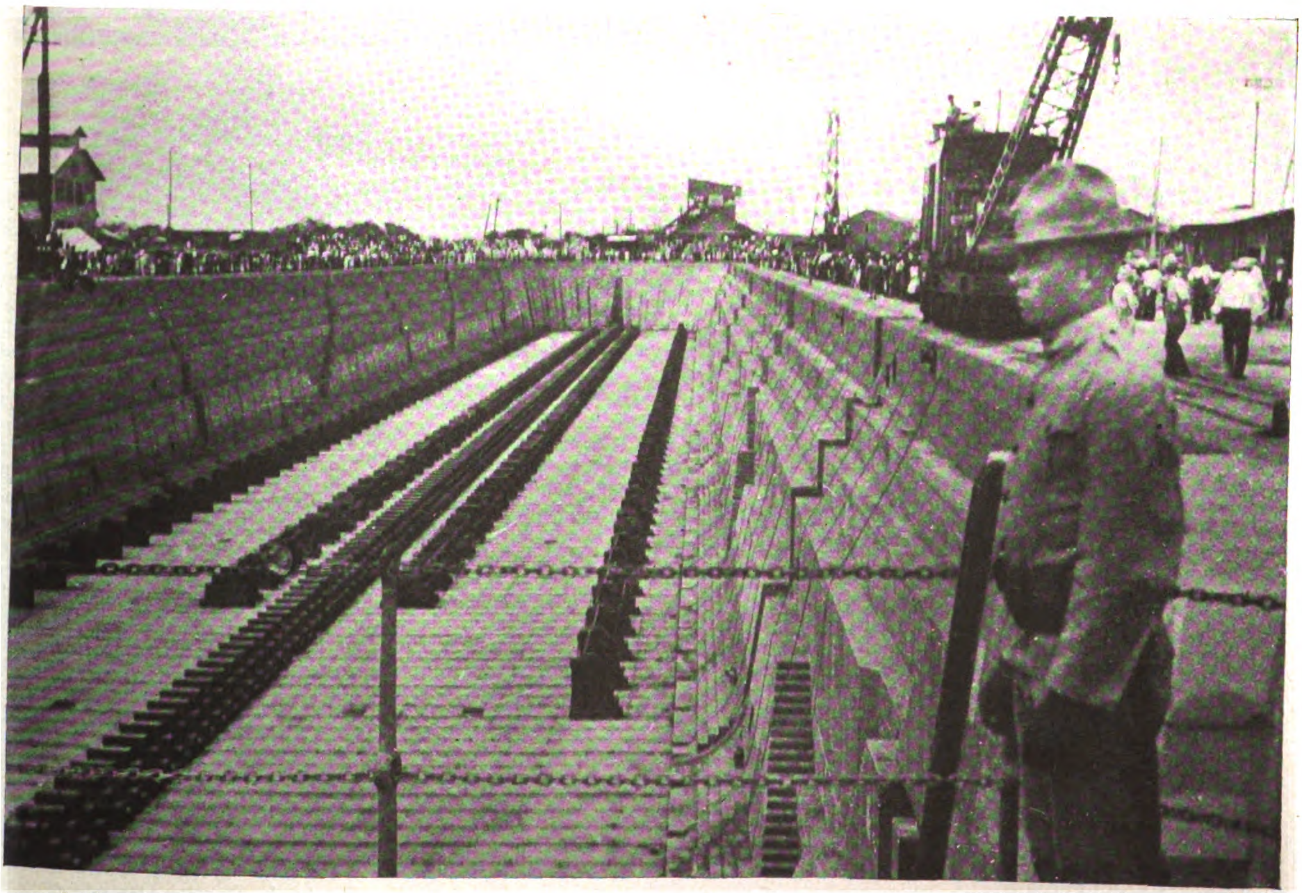
H. R. Carse, president of the Submarine Boat Corporation, Newark, N. J., has brought up for the consideration of the United States Shipping Board a proposal received from an Italian shipping company to purchase fabricated parts, machinery and equipment for a 5,350-ton steamship. The Italian corporation is also disposed to purchase four vessels of the same type and tonnage as those built by the Submarine Boat Corporation for the Shipping Board.

Six New Shipways for Baltimore

At a special meeting of the Board of Estimates of the City of Baltimore, Md., it developed that the Union Shipbuilding Company plans to spend $8,000,000 for extensions on the Brooklyn side of the Patapsco River. The extensions include the building of six additional concrete ways and the construction of four railroad tracks to route materials.

Tidewater Shipbuilders Building Machine Shop

The Tidewater Shipbuilders, Ltd., Three Rivers, Que., plans the construction of a $50,000 machine shop. M. Mapes, Windsor Station, Montreal, Room 401, is the naval architect.



(Copyright, Underwood & Underwood, N. Y.)

View of the New Drydock at Pearl Harbor, Honolulu, Which Was Recently Opened by Secretary Daniels

FLEET CORPORATION PROGRAMME TOTALS 9,205,776 GROSS TONS—984,407 TONS YET TO BE BUILT

According to figures just issued by the United States Shipping Board vessels aggregating 4,750,150 gross tons had been delivered by the Board on August 29, 1919. Vessels totalling 4,555,626 gross tons yet to be completed will bring the building programme up to 2,424 vessels with a gross tonnage of 9,205,776. Details are given in the following table:

VESSELS CONSTRUCTED BY THE SHIPPING BOARD

Delivered from 1917 to August 29, 1919

Description	Gross Tonnage	Total
899 steel ships........	3,822,415	
378 wood ships.:......	892,735	
15 composite ships....	35,000	4,750,150

Vessels Launched But Not Yet Delivered

Description	Gross Tonnage	Total
408 vessels	1,280,483	1,280,483

Vessels on Ways

Description	Gross Tonnage	Total
389 steel ships........	2,010,403	
99 wood ships........	138,000	
9 concrete ships.....	42,333	2,190,736

Vessels Contracted For; Work Not Begun

Description	Gross Tonnage	Total
227 steel ships........	984,407	984,407
2,424		9,205,776

An accurate record of the production by months during the year ending August 29, 1919, is shown in the accompanying table, which gives the deliveries of steel, wood and composite ships in gross tons:

Of the 3,687 vessels (100 gross tons and over), totaling 11,983,000 gross tons, which were recorded by Lloyd's Register as operating under the American flag on June 30—24.8 percent of the world's tonnage—1,280 ships with a gross tonnage of 5,313,780 were under the control of the Shipping Board on August 29. The following table gives the sources from which these vessels were acquired:

VESSELS CONTROLLED BY THE SHIPPING BOARD

Source	Number of Vessels	Gross Tonnage
Built by Shipping Board—		
Steel	777	3,511,918
Wood	315	728,079
Composite	15	35,000
Seized from Germany......	94	567,490
Seized from Austria.......	5	8,312
Purchased from Japan.....	15	85,880
Purchased from Austria....	5	30,521
Requisitioned from private owners	58	346,580
	1,280	5,313,780

The foregoing tabulation does not include 122 steel ships of 465,745 (deadweight) tons and 63 wood ships of 246,982 (deadweight) tons sold recently to private owners by the United States Shipping Board, nor seized foreign vessels that had been sunk.

SHIPPING BOARD DELIVERIES FOR THE YEAR ENDING AUGUST 29, 1919

	Steel		Wood		Composite		Totals	
1918	Number	Gross Tons	Number	Gross Tons	Number	Gross Tons	Number	Gross Tons
September	46	178,430	25	59,334	1	2,333	72	240,097
October	47	200,739	29	69,467	1	2,333	77	272,539
November	54	215,121	10	22,667	..	.....	64	237,788
December	30	156,260	15	36,467	1	2,333	46	195,060
1919								
January	17	88,070	7	16,667	1	2,333	25	107,070
February	27	129,933	8	16,900	2	4,667	37	151,500
March	31	136,017	11	26,700	..	.....	42	162,717
April	78	290,580	36	86,800	1	2,333	115	379,713
May	89	407,733	53	129,500	2	4,667	144	541,900
June	71	279,572	51	118,767	1	2,333	123	400,672
July	72	327,005	63	145,933	1	2,333	136	475,271
August (29th)..	56	255,050	37	84,867	2	4,667	95	344,584
Totals	618	2,664,510	345	814,069	13	30,332	976	3,508,911

Bryant Plugs and Receptacles for Marine Use

The receptacles and plugs shown herewith are properly adapted for marine use where non-watertight extension cord outlets are desired in officers' quarters, mess rooms, cabins and staterooms.

The base of this plug receptacle is unbreakable composition; the top section is hard, white porcelain, glazed. This receptacle has a bottom diameter of 1¾ inches, top diameter of 1⅜ inches, and height of 1 13/16 inches. A groove of ample size is provided in the base to allow wire entrance from the bottom of the box. Brass fastening screws of 6/32 inch are furnished, and kept in place by holding washers. Screw centers are 1⅜ inches, the standard for all Bryant marine devices.

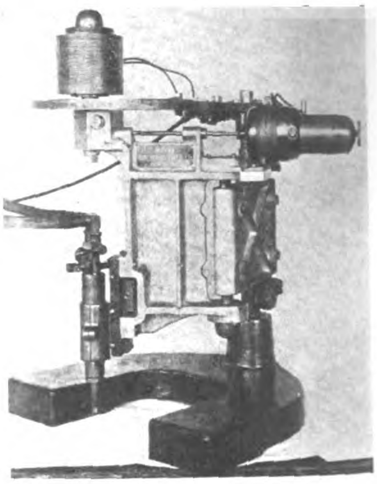
Plugs for Marine Use

Caps are provided for use on small size flexible cords not over 13/32 of an inch in diameter, and for heavy insulated or metal armored cables up to 9/16 inch in diameter. The latter are provided with a strain relief clamp and cord grip. Both types of caps are made of unbreakable composition which will stand severe usage.

Special Caps for Flexible Cords

Machine for Cutting Handholes and Other Openings in Steel Plates

The device known as the Camograph No. 2 was specially designed by the Davis-Bournonville Company, Jersey City, N. J., to cut handholes in boiler plates, and similar openings in ship plates and other wrought iron and steel sections. An oxy-acetylene flame perforates the steel, and the path traversed is controlled by an internal cam at the top, the shape of which determines the shape of the opening made. The machine is suited for cutting all openings in steel plates that cannot be produced quickly and economicaly on a drill machine. A handhole having a periphery of 12 to 13 inches can be smoothly cut in ½ to ⅝-inch steel plate.



Camograph No. 2, for Cutting Handholes

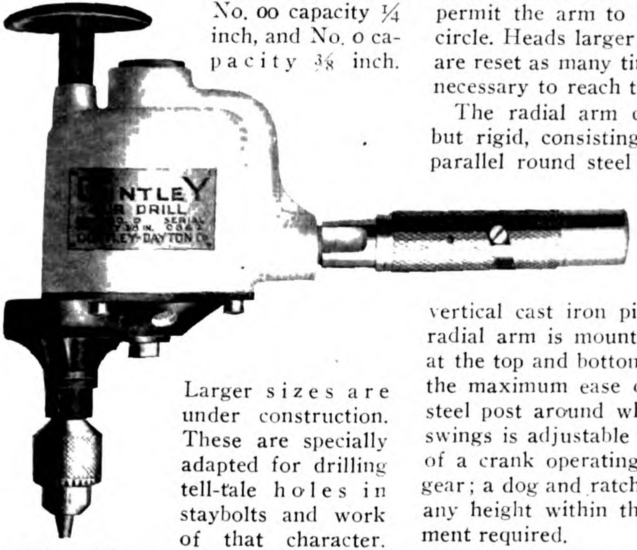
The machine comprises a cast iron base with a U-shape opening through which the torch flame strikes the work beneath. At the back of the base is a vertical post to which a double-jointed radial arm is pivoted. The cutting torch is mounted on the outer end of the radial arm which provides for movement in any direction over the entire area covered.

The shape of the opening cut in the plate being determined by the shape of the cam, it is necessary, therefore, to provide a cam plate for each shape required. The cam plate fits into a circular opening in the yoke or cam holder, and is readily removed and replaced by another. The nominal diameter of the largest hole cut with the No. 2 Camograph is 7 inches, but openings other than circular having one dimension much larger may be provided for. All thicknesses of plates used on the largest marine boilers are readily cut; while intended for cutting commercial steel plates only the power of the torch is ample for cutting much thicker metal should it be required.

New Air Drill

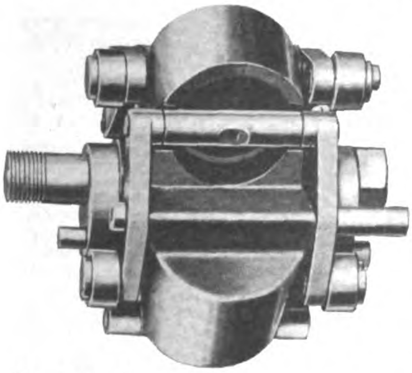
In the new air drill just placed on the market by the Duntley-Dayton Company, 1416 Michigan Ave., Chicago, there is a radical departure from standard air drill construction which makes the drill unique. The motor or power unit is quickly detachable, making it possible by the removal of three screws and a nut to replace the motor should this become necessary.

The line thus far consists of two breast drill sizes, No. 00 capacity ¼ inch, and No. 0 capacity ⅜ inch. Larger sizes are under construction. These are specially adapted for drilling tell-tale holes in staybolts and work of that character. As the motor is self-contained and well balanced, there is no vibration, a desirable feature in the performance of accurate work. The drill weighs 4½ pounds.



New Type of Duntley Air Drill

The self-contained motor consists of three pistons mounted in a frame, the entire engine rotating about a fixed crankshaft or spindle. The cylinders oscillate from a fixed base and cams on the spindle operate the valves. All working parts run in a bath of oil.



Detachable Motor or Power Unit for Duntley Air Drill

Cutting Machine for the Boiler Shop

A device known as the Pyrograph for trimming and beveling boiler sheets to correct the flange height and calking angle in one operation, by means of the oxyacetylene torch, has been placed on the market by the Davis-Bournonville Company, Jersey City, N. J.

The Pyrograph comprises a motor-driven carriage supported on a radial arm of length that provides for cutting the flange of a 9-foot diameter boiler head at one setting. While the largest diameter circle that can be cut at one setting is 9 feet, much larger work may be trimmed and beveled, inasmuch as the arm can be swung through a semi-circle of 20 feet or a full circle of 20 feet diameter provided the shop conditions permit the arm to swing in a complete circle. Heads larger than 9 feet diameter are reset as many times as may be found necessary to reach the flange all around.

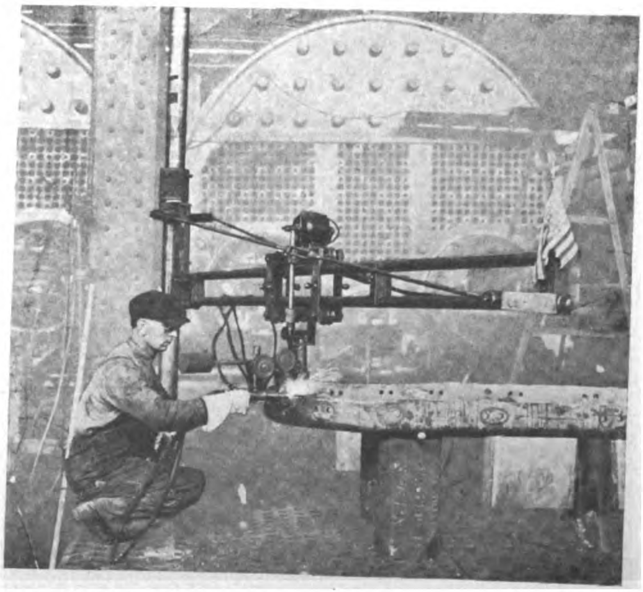
The radial arm construction is light but rigid, consisting of two cold-rolled parallel round steel bars firmly tied together by end connections and intermediate spacer blocks, supported by a truss rod. The vertical cast iron pivot member of the radial arm is mounted on ball bearings at the top and bottom in order to insure the maximum ease of movement. The steel post around which the radial arm swings is adjustable vertically by means of a crank operating a rack and pinion gear; a dog and ratchet holds the post at any height within the limits of adjustment required.

The column has a broad flanged base which may be bolted to a cast iron floorplate or a concrete foundation if required to be self-supporting, or the top of the post may be shackled to a column of the ship building and the base supported on an ordinary floor without an individual foundation.

The carriage is supported on the radial arm by four grooved ball bearing rollers which provide for the easy radial movement required to follow the feed action freely. The carriage and the arm derive their movements from the feeding mechanism which operates directly on the part to be beveled, the flange part itself acting as the track and guide for the feeding mechanism.

The torch is adjustably mounted on the carriage beneath the radial arm, and the tip may be directed at any angle required to cut to the desired calking angle. The adjustment provides for setting the tip to all angles from the vertical to the horizontal.

The vertical adjustment provided at the column is 18 inches, which is ample for all ordinary boiler flange work and many other uses. The machine may be adapted to straight line cutting and beveling the edges of flat plates by adjusting the torch for vertical cutting and providing means of engagement for the feed rollers.



Pyrograph for Trimming and Beveling Boiler Plates

Report on Cutting & Washington Radio Sets

The following is an excerpt from an interesting report received by Cutting & Washington, Inc., Cambridge, Mass., from the radio operator on the steamship *August*, a Norwegian vessel which is making a tour of the world under charter by J. H. Winchester, of the Produce Exchange, New York:

"The set has been giving perfect satisfaction throughout. There really is nothing that I would suggest by way of improvements, unless it be the introduction of some rectifier tube in place of the crystal detector (a change which all radio operators know is impossible, owing to the rather complicated patent situation at present).

"On the night of October 20, 1918, the ship, loaded with a cargo consisting solely of cased kerosene and gasoline, caught fire while at sea. The ship was at the time in the latitude of Tiensten. In spite of heavy interference from Japanese stations in the immediate vicinity, who did not answer the S O S, communication was established with the French station at Shanghai (the distance covered was about 500 miles, mostly over land)."

An Improved Paint for Smokestacks

Quite as necessary as the adequate upkeep of plant buildings and equipment by frequent painting is the necessity for the proper care of smokestacks. When a smokestack is "put out of business" with rust it means new construction and possibly a shut down of the entire plant. A special smokestack paint is now being put on the market by E. I. Du Pont de Nemours & Company, Wilmington, Del.

Marine Construction News of the Month

Ship Contracts—New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIP CONTRACTS

Messrs. Cammell Laird & Company, Birkenhead, England, has recently received a contract for a high-class steamer of 20,000 tons displacement from the Compagnie Generale Transatlantique. The vessel will be constructed and completely equipped at Birkenhead, where the vessel will be laid down as soon as a berth is available. The propelling machinery will consist of double reduction geared turbines.

The Coastwise Shipbuilding Company, Baltimore, Md., we have now been advised, is negotiating to build six four-masted schooners; four of these vessels of 2,000-tons deadweight will be constructed for the Inter-American Transportation Company, and two for the Chesapeake & South American Transportation Company.

The Consolidated Shipbuilding Corporation, Morris Heights, N. Y., has entered the lowest bid of $357,250 for building the single screw steel steam propelled lighthouse tender upon which bids were recently called.

The Gray's Harbor Motorship Corporation, Aberdeen, Wash., has laid keels for five 260-foot barkentines to be built for its own account. These vessels will be used in United Kingdom lumber trade. The ships will be made ready for engines, but these will not be installed until after the first voyage.

Harland & Wolff, Belfast, Ireland, have received a contract to build a 16,000-ton passenger steamship for the White Star Line, 9 Broadway, New York.

The Herreshoff Manufacturing Company, Bristol, Conn., has received an order to build an 80-foot schooner yacht for Carl E. Tucker, New York, for the 1920 racing season.

The Hodge Ship Company, Moss Point, Miss., is now building vessels of the Ferris type for its own acount. One vessel is now on the ways. The company has four ways, capable of building vessels up to 7,000 tons complete with machinery.

The Howard Shipyards & Dock Company, Jeffersonville, Ind., is constructing five oil barges for the Great Northern Refining Company, Lytton building, Chicago, Ill. These barges are of wood, 130 feet long, 25 feet beam and 7 feet 3 inches draft. **The Cairo Manufacturing Company, Cairo, Ill.,** has received a similar order from the Great Northern Refining Company.

The Howes Construction Company, Meteghan, N. S., has received a contract to build a bay steamer for the Valley Steamship Company to replace the Granville.

The International Ship Building Company, Pascagoula, Miss., it is reported, is about to conclude contracts for the building of six 10,000-ton vessels.

The Manitowoc Shipbuilding Company, Manitowoc, Wis., has received a contract to build two 3,200-ton deadweight fruit steamers for the Atlantic Fruit Company, 61 Broadway, New York.

McGill & McKay, Shelburne, N. S., are building four knockabout fishing vessels for J. N. Rafuse & Sons. The latter company will shortly launch a 326-ton tern schooner from its Salmon River yards.

The Mobile Shipbuilding Company, Mobile, Ala., it is reported, has received new contracts for twelve 5,000-ton steel ships.

Napier & Miller, Glasgow, Scotland, has received a contract from the Norwegian-American Line, 8 Bridge street, New York, for two 435-foot vessels of 9,000 gross tons. These ships will be constructed to burn either fuel oil or coal. Parsons turbines will be installed. The same company will build two 7,500-ton cargo vessels equipped with triple expansion engines.

The Norway-Pacific Construction & Dry Dock Company, Everett, Wash., under the direction of the new superintendent, R. Elwood Ellis, has laid two keels for the United States revenue cutters which the company is building.

The Oswall Towing Company, Three Mile Creek and Telegraph Road, Mobile, Ala., is building a large barge for carrying lumber.

The Murnan Shipbuilding Corporation, Mobile, Ala., is building two large mud scows for the Ollinger and Perry Dredging Company, Mobile, and one collier for the Coyle Coal Company, New Orleans, La., as well as a collier for the Mobile Coal Combuild two 13,000-ton vessels for the Emerwhen machinery is installed.

The Pusey & Jones Company, Gloucester, N. J., and Wilmington, Del., has received a reinstatement on the company's contract to build two 13,000-ton vessels for the Emergency Fleet Corporation.

James Rees & Sons Company, Pittsburgh, Pa., is constructing a towboat for the Carnegie Steel Company.

The G. M. Standifer Construction Company, Portland, Ore., has announced that it will build five 9,500-ton steel steamers on its own account. This company at the Vancouver, Wash., yard recently received reinstatements on the Montezuma and the Arizona, which had already been launched.

Stevens Brothers, Stockton, Cal., are constructing the following vessels: two 50-foot wooden twoboats for the Island Transportation Company, one 65-foot vessel equipped with a six-cylinder Wisconsin motor for Pollard Brothers, and one 40-foot, raised-deck, runabout cruiser for the Bay and River Dredge Company.

The Sun Shipbuilding Company, Chester, Pa., has received a contract to build a 10,000-ton cargo and passenger vessel for Dutch interests.

The Tacoma Ship Building Company, Tacoma, Wash., is constructing a motorship for the Chicago Mining Company.

The Todd Shipyards Corporation, Inc., 15 Whitehall street, New York, has received a contract from the Donald Steamship Company, Inc., 17 Battery Place, New York, for two 227-foot vessels of about 1,200 deadweight tons. The vessels will be equipped with two oil-fired boilers operating under forced draft. Triple expansion engines will be installed developing 1,400 horsepower; the vessels will make 12½ knots.

Messrs. Vickers, Ltd., Barrow-in-Furness, England, it is reported, has received a contract from W. M. Hughes, Premier of the Commonwealth of Australia, for three large cargo steamers. These vessels, it is understood, will be driven by geared turbines and will burn oil fuel. The ships will be 530 feet long, 68-foot beam and 29-foot molded depth.

The Vinyard Ship Building Company, Milford, Del., has secured a contract to finish two 88-foot tugs. The boilers of these ships were built by the International Boiler Works Company, East Stroudsburg, Pa., and the feed-water heaters by Griscom-Russell Company, New York.

PROSPECTIVE SHIP CONSTRUCTION

Two Passenger Steamships for Swedish Interests.—Representatives of the Swedish-American Line are reported to be in this country in an endeavor to place contracts for at least two passenger steamships of the Stockholm type. The American representatives of this company are Furness, Withy & Company, 34 Whitehall street, New York.

Boats for River Service.—The Liberty Transit Company, operating a fleet of packets on the Ohio River, plans to place additional boats in service. No specifications have yet been issued regarding these vessels.

Dredges, Houston Ship Canal, Tex.—Specifications are issued for four dredges which will be used in deepening the Houston Ship canal. Bids should be submitted to General Harry Taylor, United States Engineer Office.

Fruit and Freight Steamers, Boston, Mass.—The United Fruit Company, 131 State street, Boston, Mass., is planning to build a number of fruit and freight steamships for use in the West Indies service. John Hudson, pier 9, North River, New York, is the superintending engineer of the company. Maurice Eckstein, supervisor of purchases, is located at the same address.

Oil Burning Vessels, Boston, Mass.—The Fidelity Steamship Company, Boston, Mass., intends to acquire a fleet of six or eight oil burning steamers to engage in foreign trade. This company has been formed by Boston business men, with a capital of $2,000,000. Captain Arthur L. Crowley, vice-president of the Coastwise Transportation Company, is president and general manager, and A. L. Stark is treasurer.

Oil Steamers and Terminal, Harbor Island, Seattle, Wash.—The General Petroleum Company, which maintains headquarters at San Francisco and Los Angeles, operating oil fields in southern California, is planning to place a large fleet of oil steamers on the California-Seattle oil routes. The company plans the building of a large oil terminal on Harbor Island, Seattle, capable of storing [illegible] barrels. Delivery of oil in Seattle will be made by a fleet of barges, which the company plans to construct.

Ship for Automobile Trade, Detroit, Mich.—The Detroit and Cleveland Navigation Company, Detroit, Mich., is preparing plans and specifications for a 300-foot ship, which will be used in the automobile trade of the company. The boat will be of 75-foot beam. Two elevators will be installed opposite the double hatches. Turntables will be installed on each deck. Frank E. Kirby is the naval architect of the company.

Ten Vessels, Boston, Mass.—It is reported that J. S. Emery & Company, Inc., 114 State street, Boston, Mass., is about to place a contract for ten vessels.

Motorboats for Mexican Trade, Los Angeles, Cal.—Charles A. Wiley, president of the Exchange National Bank, Los Angeles, Cal., has been made president of a new $[illegible]000 concern which will operate vessels from Long Beach, Cal., to Mexican ports. The company will utilize motorboats in this service. One vessel of this type is already under construction.

Ferry Boat and Terminals, Baltimore, Md.—The Peninsula Ferry Company, Baltimore, Md., has recently increased its capital stock. The proceeds will be used in purchasing a ferry boat to be operated from Baltimore to Love Point, and in acquiring terminals. The ferry boat as constructed will have a capacity for 30 vehicles and 1,000 passengers.

Three Vessels for Pacific Coast Service, San Francisco, Cal.—The Ocean Mail Steamship Company, San Francisco, Cal., plans to build two or three steamers for coastwise trade. This company has been organized by Oliver J. Olson to carry on trade between San Francisco, Mexico and South America. Two steamers are now operated in this service.

NEW SHIP CONCERNS AND SHIPYARD EXTENSIONS

Drydock Pontoons, Kingston, N. Y.—The Kingston Shipbuilding Corporation, Kingston, N. Y., is constructing a drydock of eight sections, each 116 feet wide. The lifting capacity of each of these sections is calculated to be 2,000 tons. Five sections will probably be used as a drydock. Construction is started on three of the sections and the entire job will be completed in the early spring. The work is being carried out for the Emergency Fleet Corporation.

Drydock Pontoons, Tiverton, R. I.—The Narragansett Ship Building Company, Tiverton, R. I., has received a contract to build eight pontoons for a 12,000-ton floating drydock. These pontoons will be operated in units of five. Each pontoon is 116 feet long, 80 feet wide and 16 feet broad, exclusive of wings. The latter are 45 feet high, 16 feet at the base, 10 feet at the top and 80 feet long.

Drydock, Retaining Walls and Wharves, Chelsea, Mass.—The Winnisimmet Shipyard, Inc., Chelsea, Mass., has begun the construction of its 3,500-ton railway drydock, including the retaining walls and wharves to be used in conjunction with it. The Crandall Engineering Company, drydock engineers, East Boston, Mass., are the designers of the drydock and are superintending the construction.

Machine Shop, Power Plant and Woodworking Shop, Kewaunee, Wis.—The Wisconsin Shipbuilding & Navigation Corporation, 216 West Water street, Milwaukee, Wis., has placed a contract with McMullen & Pitz, consulting engineers, Manitowoc, Wis., for a machine shop, power plant, woodworking shop and other buildings, to cost in all $75,000. This construction will be used in connection with the company's new steel shipyard at Kewaunee, Wis.

Machine Shop, Three Rivers, Que.—The Three Rivers Shipbuilding Company, Three Rivers, Que., is adding a machine shop to its plant on Notre Dame street.

Marine Electrical Company, Galveston, Tex.—The Marine Electrical Corporation has been organized at Galveston, Tex., to handle all repairs and installations of electrical equipment for ships at this port. The officers of the company are: J. B. Gribble, Jr., president; Conley Lloyd, vice-president, and J. Hamilton Mills, secretary and treasurer.

Marine Railway, Mobile, Ala.—Harrison Brothers, Palmetto street, Mobile, Ala., have just completed an addition to their ship repair plant of a 500-ton marine railway. In addition to repair work the company handles the construction of barges, launches and schooners.

Pattern Shop, Philadelphia, Pa.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has let a contract to M. H. McClosky, Jr., 1620 Thompson street, Philadelphia, Pa., for building a pattern shop at the Philadelphia Navy Yard.

Ship Chandlery Company Reorganized, New York, Philadelphia, Baltimore.—The ship chandlery company, known as the S. P. Blackburn Company, with offices at 13-15 Coenties Slip, New York, 129 South Second street, Philadelphia, and 510 East Lombard street, Baltimore, has been taken over by the Joseph J. Keegan Company, composed of Joseph J. Keegan, A. Frank Stafford, James C. Lynch, Harvey E. Busch and Charles W. Geiger.

Shipbuilding Company, Mobile, Ala.—The Kelly Shipbuilding Company is the name of the new concern which has recently located on the east side of the Mobile river opposite the foot of Beauregard street, Mobile, Ala. The plant at present consists of a fully equipped marine railway, capable of handling vessels up to 1,800 tons. The officers of the company are: Thomas J. Kelly president; L. L. Bodden, vice-president, and E. A. Kelly, secretary.

Shipbuilding Company, New Orleans, La.—The Kayser-Hagedorn Engineering Works, Inc., New Orleans, La., is a new concern which has just been organized to specialize in shipbuilding, both heavy and light, as well as machine and casting business.

Shipbuilding Company, Rossie Island, Mountrose, N. B.—The Coaster Construction Company, Glasgow and Mountrose, N. B., has completed the initial layout of the shipyard at Rossie Island, Mountrose, for the construction of coastal vessels, tugs, barges, etc. The yard covers an area of 20 acres, and can accommodate vessels up to 360 feet in length.

Shipyard Combine, Marshfield, Ore.—The Coos Bay Shipbuilding Company, Marshfield, Ore., will be combined with a sawmill to be erected on 26 acres of land adjoining it. The new company will be a stock concern, in which A. E. Adelsperger and W. J. Conrad, of Marshfield, Ore., are interested.

Shipyard Conversion, Warrenpoint, Ireland.—The Liberty Shipbuilding and Dry Dock Company, Warrenpoint, County Down, Ireland, has been changed from a concrete to a steel shipbuilding yard. Keels of two fair-sized steel steamers have already been laid. These vessels, it is said, will be built almost entirely by the electric welding process.

Shipyard Discontinued, Portland, Ore.—The Grant Smith-Porter Ship Company, Portland, Ore., has turned over its yard to the United States Shipping Board. The plant will be used as an assembly yard for salvage materials.

Shipyard Extension, Baltimore, Md.—The Union Shipbuilding Company, Baltimore, Md., plans to spend $8,000,000 for extensions on the Brooklyn side of the Patapsco River. The extensions include the building of six additional concrete ways and the construction of four railroad tracks to route materials.

Shipyard Improvements, Mobile, Ala.—The Henderson Shipbuilding Company, Mobile, Ala., is erecting steel extensions 60 feet wide by 10 feet long to its main building as a further aid in the swift repair of vessels at the plant.

Shipyard Reorganization, Portland, Ore.—The Martinolich Shipbuilding Company, Portland, Ore., has been purchased by John L. Roberts, president of the Puget Sound Iron & Steel Works. The sale price does not include auxiliary schooners under construction for Norwegian interests.

Shipyard Reorganization, Tampa, Fla.—Philip Shore, Tampa, Fla., has taken over the plant of the Gulf Shipbuilding Company. Additional machinery, it is reported, will now be installed.

Shipyard Reorganization, Vancouver, Wash.—The Reed Engineering Company, Vancouver, Wash., has acquired the physical property and business of the Motorship Construction Company of that city. The latter company was founded in 1917 by Merrill A. Reed and S. S. Hewett. The Oregon Shipbuilding Company was later consolidated with the Motorship Construction Company. During the war this company turned out the largest contracts for steel life boats on the Pacific Coast, averaging ten a day. In addition the company built 32 cutters for the Bureau of Construction and Repair of the United States Navy. The incorporators of the new company are Merrill A. Reed, Dr. R. D. Wiswall and W. J. Kinney.

Shipyards, Glasgow, Scotland.—Harland & Wolff, Belfast shipbuilders, Belfast, Ireland, have recently acquired two new shipyards, one of these run by its competitor, D. & W. Henderson, Ltd., Glasgow, Scotland, and the other by A. & J. Inglis, also of Glasgow.

Steamship Company, New York.—The Crescent Steamship Lines, Inc., has recently been formed, with a capital of $1,000,000, with Edward J. Dalton, formerly vice-president, treasurer and chief operator of the Triangle Steamship Company, as president and treasurer of the new company. Temporary offices have been opened at Room 701, 44 Whitehall street, New York.

PROPOSED CONSTRUCTION

Coaling Wharf and Central Power Plant, New Orleans, La.—The Algiers Navy Yard, New Orleans, La., is about to begin construction of a coaling wharf to cost $100,000 and the building of a central power plant to cost $280,000.

Docks and River Terminals, Pascagoula, Miss.—The sum of $75,000 is available for the construction of docks and river terminals at Pascagoula, Miss., to be used in connection with the coal and general freight handled on the Mississippi-Warrior river line.

Drydock, Vancouver, Wash.—A. L. Haley, engineer of the Vancouver, Wash., Port Commission, is urging the construction of a floating drydock capable of handling vessels of 12,500 tons capacity. For this construction he proposes a site near the Standifer shipyard. The G. M. Standifer Construction Corporation, Vancouver, Wash., it is reported, will donate $100,000 to build this drydock, if the Government appropriates $150,000 and the city $100,000.

Floating Drydock, Sparrow's Point, Md.—The Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., we are officially advised, is preparing plans for a new floating drydock of about 6,000 tons capacity to be erected at Sparrow's Point. Unofficially we learn that this construction will be 400 feet long, 80 feet wide and 20 feet deep. The drydock will be electrically equipped.

Harbor Development, Birmingham, Ala.—The City of Birmingham, Ala., is planning the construction of a temporary port at Birmingham for the immediate requirements of the traffic. Charles Francis Wood, chief engineer, 1803 Jefferson County Bank building, is preparing plans and specifications for letting contracts for this work within thirty days. At least two locomotive cranes, one small switching engine and a number of belt or pan conveyors will be installed in the port, which will probably be in operation by January 1, 1920. Eventually freight-handling equipment to cost between $2,500,000 and $3,000,000 will be installed at this port. The Warrior River Development Committee has voted to incorporate the "Port of Birmingham Company," with a capital of a minimum of $600,000 authorized and a minimum of $150,000 paid in. This company will work for the permanent development of the port of Birmingham.

Machine Shop, Three Rivers, Que.—The Tidewater Shipbuilders, Ltd., Three Rivers, Que., plans the construction of a $50,000 machine shop. M. Mapes, Windsor Station, Montreal, Room 401, is the naval architect.

Oil Terminal, East Providence, R. I.—The New England Oil Company, Devonshire street, Boston, Mass., plans to erect a $1,500,000 oil terminal at East Providence, R. I., on a 176-acre site. H. D. Corcoran is the manager of the concern.

Piers and Coal Docks, Jacksonville, Fla.—The Southern Coal Company, Jacksonville, Fla., has been incorporated to construct piers and coal docks at that city. The officers of the company are: F. W. Eanson, president; R. B. Tupper, vice-president, and J. E. Baines, secretary and treasurer.

Ship Repair Plant, Chester, Pa.—The Merchant Shipbuilding Corporation, Philadelphia, Pa., announces that it has not yet arrived at a definite decision regarding the project of building a ship repair plant at its Chester yard.

Ship Repair Plant, Staten Island, N. Y.—The Morse Dry Dock & Repair Company, Brooklyn, N. Y., has recently purchased an extensive tract of land on Staten Island, N. Y. The company is not in a position at this time to announce its plans regarding the purchase, but it is reported that construction work of a new repair plant will probably be begun upon the site early in 1920.

Shipbuilding Company, Trenton, Mich.—The Purdy Boat Company, capitalized at $75,000, has recently purchased a tract of land at Trenton, Mich., upon which the company will erect a shipbuilding plant to construct cruisers and other boats of the same character as are now built at the yard in Miami Beach, Fla.

Shipyard, Hebburn Colliery, Scotland.—George Renwick, M. P., well-known Newcastle shipbuilder, will shortly begin the construction of a new shipyard near Hebburn Colliery. R. S. Dalgliesh, another Newcastle shipbuilder, is said to be connected with the development.

Shipyard Extension, Jersey City, N. J.—The Morgan Engineering Company, Jersey City, N. J., will enlarge its present plant to include two large drydocks for ship repair work.

Terminal Developments, Ship Canal, Tex.—Private interests are planning extensive terminal developments, including steamship piers to be built on the Texas ship canal. The project is now being financed. R. H. Baker, Union National Bank building, Houston, Tex., staes that details will be issued as the proposition develops.

HARBOR CONSTRUCTION

Bulkhead, Philadelphia, Pa.—The McLean Construction Company, Philadelphia, Pa., has submitted the lowest bid for the construction of the Schuylkill River bulkhead at Philadelphia, Pa.

Concrete Caisson Breakwater and Lighthouse Crib, Indian Harbor, Ind.—The Great Lakes Dredging & Dry Dock Company, Chicago, Ill., will construct a concrete caisson breakwater and lighthouse crib at Indian Harbor, Ind., to cost about $105,000.

Concrete Pier, Baltimore, Md.—The McLean Contracting Company, 1412 Fidelity building, Baltimore, Md., has received a contract from the Baltimore & East Shore Ferry Company, Inc., 110 East Lexington street, Baltimore, Md., to build a reinforced concrete pier to cost about $100,000.

Dredging, Schuylkill River, Pa.—The American Dredging Company has received a contract for dredging in the Schuylkill River to cost about $25,000. The Maryland Dredging & Contracting Company has received a similar contract for work involving over $342,000.

Dredging, St. John's River, Fla.—P. Sanford Ross, Jersey City, N. J., has received a contract for dredging in St. John's River, Fla. The work wil cost about $105,000.

Harbor Improvements, Vancouver, B. C.—About $18,000 has been spent in improving the harbor at Vancouver, B. C.

Harbor Improvements, Victoria, B. C.—About $21,000 has been spent in improving the harbor at Victoria, B. C.

Pier Extension, Sandusky, O.—The Pringle Barge Line Company, Sandusky, O., has awarded a contract to the Stanton Brothers Company, Cleveland, O., for the extension of its docks at the foot of Lawrence street.

EQUIPMENT

Dipper Dredge, New York City, N. Y.—Colonel Richard T. Coiner, United States Army Engineer, Room 710, Army building, New York City, will receive bids until October 10 for the construction and delivery of a dipper dredge. Complete specifications will be furnished on application.

Diesel Engines, Greece.—The commercial reports of the Department of Commerce state that there is a large demand in Greece for marine engines of from 50 to 200 horsepower. These are chiefly oil engines of the Diesel type. The two main considerations are simplicity of construction and operation and economy of fuel consumption.

Elevators, Detroit, Mich.—The Detroit and Cleveland Navigation Company, Detroit, Mich., will install two elevators for handling automobiles on a 300-foot vessel, which the company is planning to construct. Frank E. Kirby is the marine architect of the company.

Metal Lifeboats, Mobile, Ala.—The Mobile Steel Company, Mobile, Ala., has just completed a Government order for furnishing 300 metal lifeboats for the Navy. These boats were shipped to the Navy Yards at New York, Philadelphia and Norfolk.

Outfitting Vessels, Victoria, B. C.—The Cholberg Shipyard Company, Victoria, B. C., has received a contract to complete and outfit three wooden vessels which the Universal Shipping & Trading Company recently purchased from the Shipping Board.

Spars and Top Masts, Wilmington, Del.—The Columbia Spar Company, Orange, Tex., has received a large order for spars and top masts for shipbuilders in Wilmington Del. The company also holds an order for thirty-two 85-foot spars.

Turn Tables, Detroit, Mich.—The Detroit and Cleveland Navigation Company, Detroit, Mich., will install turn tables on each deck of a 300-foot vessel which the company is planning to construct. Frank E. Kirby is the marine architect of the company.

Wireless Sets.—The Marconi Wireless Telegraph Company of America, Woolworth building, New York, has recently received a contract to outfit 81 ships of the Standard Oil Company with Marconi sets. According to an announcement by Arthur Isbell, district superintendent, about 90 percent of the privately owned ships on the Atlantic Coast are fitted with wireless sets of the company.

GOVERNMENT SUBMARINE CHASERS AND YACHTS FOR SALE

Motor Submarine Chasers and Yachts, Washington, D. C.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will sell on October 8 a large quantity of 110-foot seagoing motor boats used by the Navy during the war. These submarine chasers have wooden hulls, built on the lines of a trawler, so that they can stay out in heavy weather. The vessels are equipped with three 220-horsepower, six cylinder, heavy duty gasoline engines. On October 15, five motor yachts ranging from 44 to 94 feet in length will also be offered for sale.

Marine Engineering Representatives

New England Manager: S. I. Carpenter,
294 Washington Street, Boston, Mass.

MARINE ENGINEERING may be purchased at the following News Stands:

Boston, Mass.

Old Corner Book Store, 27-29 Bromfield Stre

New York City, N. Y.

Produce Exchange, Beaver Street
Whitehall Building News Stand, 17 Batte Place
Eastern Hotel News Stand, Whitehall an South Street

Baltimore, Md.

L. T. Taylor, 2215 Orleans Street
Representative in Baltimore and Sparrows P

Savannah, Ga.

J. Gardner, 18 Broughton Street, East

New Orleans, La.

Staub News Depot, 735 Common Street

San Francisco, Cal.

Foster & Orear, Ferry Building

Seattle, Wash.

Archway Bookstore, 3rd and Pike Streets
Lowman & Hanford Company, 1st Avenue a Cherry Street

TRADE NOTES

The automatic fire alarm designed as a marine fire detection system by the Fire Detecting Wire Company, Inc., 2 West 45th street, New York, is now available for private installation. The system consists in the wiring of the hazardous parts of the ship with a continuos thermostatic wire operating on every inch of its surface. This wire is attached to indicators and fire bells on the bridge.

The Electrolytic Oxy-Hydroge Laboratories, Inc., New York sales office 15 William street, announces the formation of a sales and manufacturing company under the name of the Electr Company. The general offices and works of both companies will be located at 2 Penn avenue, Pittsburgh, Pa. Branch sales offices are being opened in the Morris building, Philadelphia, Pa., and the Merchants Exchange building, San Francisco, Cal.

The Keller Pneumatic Tool Company Chicago and Grand Haven, Mich., announces the opening of the following branch offices: Birmingham, Ala., Jefferson County Bank Building, under the management of H. I. Kahn; Salt Lake City, Utah, Newhouse Building, under the management of the C. H. J Company; San Francisco, Cal., under the management of Eccles & Smith Company, with branch offices at Port and Los Angeles.

W. H. Woody, division manager the Keller Pneumatic Tool Comp Munsey Building, Washington, D. C. has been awarded a victory loan me made from German cannon. The presentation was made by the Vi Liberty Loan Committee, Port Va.